DRAFT

GRASSHOPPER/MORMON CRICKET CONTROL PROGRAM

MULTIAGENCY ENVIRONMENTAL ASSESSMENT

EA-NV-010-1-011

1981

Prepared by

BUREAU OF LAND MANAGEMENT
BUREAU OF INDIAN AFFAIRS
U.S. FOREST SERVICE

DRAFT

United States Department of the Interior

IN REPLY REFER TO
1791 (N-011)
EA-NV-010-1-011

BUREAU OF LAND MANAGEMENT
ELKO DISTRICT OFFICE
P.O. Box 831
Elko, Nevada 89801

JAN ? 1981

Dear Public Land User:

This is a copy of the draft environmental assessment (EA) for the 1981 grasshopper/Mormon cricket control program. The EA is a comprehensive analysis of the environmental impacts that could occur if the proposed action or an alternative control method was implemented.

Due to extremely constricted time frames, all input from affected agencies and commissions may not have been received in time for inclusion in this draft. Submissions received during the comment period will be incorporated in the final EA and decision process.

Please review the document and supply any comments you may have to this office no later than February 10, 1981. Observing this deadline will enable us to report our final decisions to APHIS by the required March 1, 1981 date.

Thank you for your interest and cooperation.

Sincerely yours,

Rodney Harris
RODNEY HARRIS
District Manager

Record of Decision/Finding of No Significant Impact
1981 Grasshopper Control Program
Elko, Winnemucca, and Battle Mountain Districts
Nevada

DECISION

BLM requests that the Animal and Plant Health Inspection Service (APHIS) control grasshopper and Mormon cricket infestations on public lands in the Elko, Winnemucca, and Battle Mountain Districts. Control will occur on BLM administered lands in areas identified through the 1980, and corroborated by the 1981, adult grasshopper survey conducted by APHIS within the areas covered by the EA or supplements thereto. The Proposed Action has been reviewed by the BLM in the Multiagency (BLM, BIA, USFS) Environmental Assessment (EA) No. NV-010-1-011 and the control methods will be:

1. Implementation of the Proposed Action, which involves applying 91% technical malathion at a rate of 8 ounces per acre, carbaryl/Sevin 4 Oil at a rate of 7.84 ounces actual per acre, or 5% carbaryl bait at a rate of 5-40 pounds per acre by aircraft or ground vehicle in nonsensitive areas, strictly following label requirements and State water quality standards.

2. Implementation of the biological alternative, which involves applying rolled bran bait innoculated with *Nosema locustae* in sensitive areas (except Swainson's hawk areas where no control measures will be undertaken within one-quarter mile of active nest sites), strictly following label requirements. If *Nosema locustae* is not available at the time of application, sensitive areas can be treated with 5% carbaryl bait.

   Sensitive areas are defined as areas containing: a) Federal or State sensitive plants; b) class I fishery streams; c) Swainson's hawk nest zones (no control); d) Clover Valley speckled dace habitat.

The EA identifies areas requiring special consideration. These needs are addressed by the mitigating measures which will be adhered to as part of this decision. The mitigating measures are as follows:

a. Federal or State sensitive plants will be avoided by not spraying malathion or carbaryl/Sevin 4 Oil within two miles of known locations, except in the case of the Federally listed *Astragalus yoder-williamsii* and a plant of high priority for Federal listing, *Eriogonum argophyllum*, which are to be avoided by a five-mile radius area. Five percent (5%) carbaryl bait may be applied in these areas. (See attached maps in the EA.)

b. Spraying will not occur in areas that average less than eight grasshoppers per square yard.

c. Interagency quality control monitoring will be conducted before, during, and after any pesticide application in selected areas. Such monitoring will determine whether the application achieved the

desired effects and whether there are any significant, unanticipated effects. Short-term ecological effects will be evaluated and recommendations for procedural changes can be incorporated into later applications.

d. The sand dune systems of Paradise Valley, Silver State Valley, and Desert Valley in Humboldt County will be excluded from any application of insecticides due to the unique habitat there and the high number of known endemic insects.

e. No treatment within municipal watersheds will occur unless requested by the authorized local governing body in writing. If treatment is requested, malathion or carbaryl/Sevin 4 Oil will not be used in municipal watersheds. Carbaryl 5% bait may be applied on selected sites, such as egg beds, or in strip application in front of migrating juvenile or adult Mormon crickets.

f. Control methods will ensure that no direct application of pesticides will occur in any Class I fishery streams. (Maps will be provided by Bureau of Land Management/Nevada Department of Wildlife.)

g. No pesticide will be applied within one-quarter mile of any active Swainson's hawk nest sites as determined by the Nevada Department of Wildlife. (See Appendix 8 in the EA.)

h. All label instructions will be followed per EPA guidance. (See Appendices 2, 9, and 10 in the EA.)

i. BLM will close its developed campgrounds utilizing surface waters as sources of drinking water the day of spraying and the following three (3) days. The use of surface water for drinking from these sites will be prohibited until testing confirms the water to be free of malathion. Furthermore, notices will be posted at these sites advising the public that the area has been sprayed for grasshopper control and a possible health hazard exists with surface water consumption after periods of precipitation. A thorough public information program will precede the spray program advising the public of areas to be sprayed, site closures and possible health hazards.

RATIONALE

The grasshopper control program is evaluated in the final EA. The assessment analyzes the proposed action and four alternatives: Biological Control, Cultural Control, Integrated Pest Management (IPM), and No Action. This decision reflects implementation of the Proposed Action in nonsensitive areas and the Biological and/or carbaryl bait control alternative in sensitive areas. These control methods are not expected to impact sensitive species.

Through consultation with the U.S. Fish and Wildlife Service, the endangered plant Astragalus yoder-williamsii was determined to be the only T&E species whose continued existance may be jeopardized by the proposed action. However,

resource specialists agree that the mitigating measures ensure that T&E species will not be significantly impacted by the proposed action if implemented as specified in this decision.

Neither of the Biological Control alternatives were chosen for widespread usage for the following reasons: (1) funnel web spiders are still experimental in nature, (2) Nosema locustae is not considered by APHIS to be an operational methodology pending completion of their evaluation studies. Use of Nosema on large acreages also requires that sufficient lead time be made available to the manufacturer to prepare the innoculum. The manufacturer has stated that sufficient innoculum can be provided this year to treat several thousand acres.

The Cultural Control alternative which consisted of removing or reducing grazing animals including livestock, wild horses, and some wildlife was rejected because it is impractical and does not control pest infestations in the short-term. Integrated Pest Management (IPM), as defined in the President's 1979 Environmental Message, uses a systems approach to reduce pest damage to tolerable levels through a variety of techniques, including natural predators and parasites, genetically resistant hosts, environmental modifications, and when necessary and appropriate, chemical pesticides. IPM strategies generally rely first upon biological defenses against pests before chemically altering the environment.

IPM was rejected because of present uncertainty over the Biological Control portions and because some of the Cultural Control options cannot be implemented without completion of court mandated grazing EISs. The No Action alternative was rejected because pest infestation levels may remain high leading to damage to other resource values and a continuing risk of mass migration to and destruction of agricultural lands.

Other factors taken into consideration in formulating this decision included State laws and other agencies' (both State and Federal) policies and recommendations.

FINDING OF NO SIGNIFICANT IMPACT (FONSI)

The EA adequately analyzes the environmental impacts of the proposed action and alternatives. The proposed action and its residual impacts should not significantly affect the quality of the human environment. Therefore, the preparation of an environmental impact statement is not required.

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Table of Contents

Summary

An Adult Grasshopper/Mormon Cricket Survey by USDA, Animal Plant Health Inspection Service (APHIS), to identify potential infestations has been completed. Some 682,000 acres of grasshopper economic infestations (8 or more grasshopper per square yard) and 17,000 acres of Mormon cricket areas have been identified on BLM, BIA, and USFS managed lands over a five county area in Northern Nevada. Five alternative methods--including the proposed action of applying ultra low volume malathion, Carbaryl/sevin-4-oil or carbaryl bait--for pest control have been studied, and general findings are as follows:

1. The proposed action applied without mitigating measures has a high potential for major interruptions in food webs of fish, insectivorous birds, mammals, and reptiles. Sublethal effects on small mammals, birds, and fish, making them more susceptible to predation, could result. Direct or secondary mortality of fish, birds, and both beneficial and endemic arthropods is possible. Disruption or loss of pollinating systems of "sensitive" plants could also occur. Any or all of these effects could result in direct adverse impacts to wilderness and recreational values.

2. The no action alternative, which proposes no control of grasshopper/Mormon cricket infestations, could result in losses of livestock and wildlife forage. Soil erosion and sediment loads in streams could occur if massive amounts of vegetation were removed by grasshoppers. This would, in turn, have a direct adverse impact on fishery habitat, water quality, soil structure, forage production, and other factors.

3. Biological control would work more slowly to control infestation and could result in some forage loss.

4. Cultural control, aside from the obvious economic impact on the ranching community, would have the same impacts as those indicated for the no action alternative for the several years required before this method takes effect.

5. Integrated pest management (IPM) could effectively control grasshopper infestation and minimize the adverse impacts of the alternatives involved (proposed action, biological control, and cultural control).

Should the mitigating measures suggested for the proposed action be imposed, impacts could be somewhat reduced.

The measures to reduce impacts to federally listed Threatened and Endangered species may be altered after formal consultation and approval from the U.S Fish and Wildlife Service. An amendment or supplement to this document would reflect those approved changes.

Grasshopper/Mormon Cricket Control Program

Multiagency Environmental Assessment

EA-NV-010-1-011

I. Description of the Proposed Action and Alternatives

A. Introduction: Purpose and Background

Damage to rangeland and cropland by periodic outbreaks of grasshoppers and Mormon crickets has been well documented in the historical record of the western United States. In 1934, the Department of Agriculture was charged by Congress to assist in the protection of rangeland and cropland from the destruction caused by infestations. Since receiving this responsibility, the Department's Animal and Plant Health Inspection Service (APHIS) has been actively engaged in controlling grasshopper populations, primarily through the use of chemical insecticides. The objective of APHIS is "to cooperatively develop practical management plans to suppress economic grasshopper and cricket infestations on rangelands that will protect the range vegetation and reduce or prevent large-scale movement to susceptible crops with the least unfavorable environmental consequences" (USDA 1980).

APHIS first determines where economic infestations are likely to occur, then advises landowners and land managing agencies of the potential outbreak and recommends treatment be requested. Once potential impacts from treatment are evaluated and found to be acceptable, the land administrators issue a workable request. Upon receipt of this request, APHIS then plans, schedules, and supervises treatment if grasshopper populations are of economic proportions.

In determining the need for treatment, APHIS conducts three grasshopper surveys. The Adult Survey, conducted in mid to late summer, establishes the potential grasshopper infestation for the coming year. The Nymphal Survey, carried out the following spring, is a continuous observation of the areas identified during the previous fall to determine hatching populations. The Delimiting Survey, conducted in late spring, enables APHIS to determine the exact boundaries of treatment blocks.

Spring weather is critical. Adverse conditions can induce natural grasshopper mortality and treatment would not be warranted, as was the case in most areas during the spring of 1980. Prevalent conditions affecting grasshopper populations are as follows:

Conditions causing mortality

Spring: Warm weather allowing premature hatching, followed by low temperatures that prevent normal development.

Late Spring: A short period of hot weather to ensure complete egg hatch, followed by long periods of cloudy wet weather that stimulate disease in the grasshoppers.

Summer: Cool weather for delaying maturity and restricting the egg-laying period.

Fall: Early fall to further shorten the egg-laying period.

Conditions increasing population

Spring: Cool and wet weather, preventing premature hatching and ensuring an adequate food supply.

Late Spring: Several weeks of warm dry weather, allowing for complete hatching and good feeding conditions.

Summer: Hot weather, with sufficient rainfall to maintain an ample food supply but with no extremely wet periods to encourage disease in the grasshoppers.

Fall: Late fall, extending the egg-laying period.

APHIS conducted adult grasshopper surveys throughout northern Nevada during the fall of 1980. Numerous areas within Elko, Eureka, Humboldt, Lander, and Pershing Counties were found to support potentially economic (over 8 grasshoppers per square yard) or subeconomic (3-7 grasshoppers per square yard) grasshopper populations. In some small, localized areas, infestations of 50 or more grasshoppers per square yard were documented. APHIS has since recommended that land managers request treatment. Federal land administered by several agencies is involved.

In 1980, APHIS prepared an environmental impact statement (EIS) for grasshopper control in the western United States. That document analyzed impacts to the environment from a broad perspective. This environmental assessment (EA) analyzes more site-specific impacts that would occur under various alternative control methods.

The EA is being prepared jointly by the Bureau of Land Management (BLM), Bureau of Indian Affairs (BIA), and United States Forest Service (USFS). Since the majority of the federal land acreage proposed for treatment is BLM administered, BLM has been designated as the lead agency.

An estimated 2.2 million acres, made up of a number of land blocks varying in size from approximately 400 to 1,517,600 acres, were determined to potentially support economic or subeconomic populations of grasshoppers. Of the 682,000 acres

likely to be economically infested, approximately 421,480 are federally administrated (270,070 BLM; 108,440 USFS; and 42,970 BIA) and 260,520 are private. (See attached maps for the locations of infestations). It should be kept in mind that the proposed acreages are subject to change, depending on APHIS's spring surveys.

Past treatments for grasshopper infestations in northern Nevada have been limited to small blocks of land. Since 1971 a total of 188,000 acres have received treatment, ranging from 832 acres in 1974 to 40,704 acres in 1979. (See Appendix 1 for a history of malathion use in northern Nevada.)

In addition to treating grasshoppers, APHIS has also recommended treatment of some 17,000 acres of Mormon cricket infestations. This acreage is made up of several small blocks of land. (See attached maps.) As methods of controlling these infestations do not significantly differ from those available for grasshopper control, they will also be included as part of this EA.

The predominant target pests identified by APHIS are the migratory grasshopper, Melanoplus sanguinipes (Fabricius) and Mormon cricket, Anabrus simplex (Hald).

B. Land Management Policies

Generally, policies of the various agencies involved concerning pesticide use are similar. Some of the most important points in common are as follows:

Chemicals not registered by the Environmental Protection Agency (EPA) in full compliance with the Federal Insecticide, Fungicide, and Rodenticide Act will not be used.

Label directions for use of pesticides must be followed. (See Appendix 2 for labels.)

Pesticides will be recommended and used only after a consideration of alternatives. This consideration must be based on a competent analysis of the environmental impacts and benefit-cost ratios. Both factors must clearly indicate that pesticide use is essential to meet management goals. The full range of alternatives, including cultural, mechanical, manual, biological, chemical, and regulatory methods, must be considered (FSM 2150.3).

Agencies will develop, practice, and encourage the use of integrated pest management (IPM) methods, systems, and strategies which provide protection of resources with the least hazard to man and his possessions, wildlife, fish, and the environment (FSM 2140.3).

Spray blocks must be laid out in a manner which will prevent or minimize drift of sprayed pesticide into streams, lakes, nontarget pastures, apiaries, croplands, and residences (FSM 2155.22).

Pesticides will be used only when there is a basis for belief that water quality will not be degraded or that hazards will not exist that would unnecessarily threaten fish, wildlife, their food chain, or other components of the natural environment (BM 9222.06 Appendix 1, page 1).

Large-scale nonspecific applications will not be made of any pesticide (BM 9222.06 Appendix 1, page 2).

Pesticide or herbicide use must be coordinated with all concerned state or federal agencies to prevent contamination of the aquatic environment. Safeguards include, but are not limited to, no spray areas near streams, correct timing, intensive surveillance, and use of minimum concentrations of chemicals (BM 6762.34c).

C. Alternatives Including the Proposed Action

1. Proposed Action

APHIS proposes to reduce economic populations in infested areas with a single application of one of three chemical insecticides available. Insecticides available and proposed rates of application would be as follows:

Malathion, 91% technical, applied ultralow volume (ULV) at a rate of 8 oz. actual/acre.

Carbaryl/Sevin 4 Oil, 49% Active Ingredient, at a rate of 20 oz./acre (16 fl. oz. Sevin 4 Oil plus 4 oz. diesel fuel), which is 7.84 oz. actual/acre.

Carbaryl bait, 5% Active Ingredient, 95% steamrolled wheat or wheat bran, at a rate of 5-40 lbs./acre. This application rate is based on various factors, such as status of population, habitat, and weather.

Grasshopper populations would normally be controlled with ULV Malathion or Carbaryl/Sevin 4 Oil, whereas with Mormon cricket populations, ULV Malathion or Carbaryl bait would be used. Application would be done by aircraft and/or ground rig. (See Appendix 3.) The proposed action would be conducted between May and July 31, depending on the time of peak grasshopper/Mormon cricket hatch in any given treatment area. APHIS, being the application expert, would determine the appropriate schedule and equipment to be used in order to ensure the operation conforms to the standards and stipulations required by the requesting agency.

2. No Action

With the no action alternative, no control measures would be undertaken, allowing natural climatic and biological processes to control areas of elevated grasshopper population.

3. Biological Control

With this alternative, organisms would be applied to infested areas in sufficiently large populations to reduce the target pests through disease or predation. Organisms selected would usually be naturally occurring components of the ecosystem. However, their populations are not normally large enough to control the pest. Therefore, they must be cultured or raised in the laboratory, then artifically introduced into the environment. (See Appendix 4.) At this time two biological controls are available:

a. Nosema locustae, a protozoan, registered with the E.P.A. for grasshopper control. This organism infects the gut of grasshoppers and some species of crickets, including the Mormon cricket. It specifically attacks the stored fat bodies in the host, resulting in a loss of needed energy reserves for growth and development. While Nosema naturally occurs in grasshopper populations, dispersal of bait containing protozoan spores into grasshopper infested areas allows for a more rapid infection of the pest population.

   Although registered for use, Nosema is unavailable unless sufficient time is given to culture the organism. APHIS must inform producers of the protozoan by mid-February if sufficient quanties are to be available by the time control measures are needed. APHIS is currently awaiting its final test results on Nosema before any large-scale use will be conducted. These results are not expected for several years.

b. The funnel-web spiders of the Family Agelenidae consists of species which prey on grasshoppers. A control program using these spiders is currently being tested (Riechert 1980, personal communication). Native species of the Agelenidae would be used and egg cases would be released in the pest areas, providing an immediate increase in the predator following a pest increase. As the spiders are not poisonous to man or other mammals and would control their own numbers by territorial spacing as pest numbers dropped, no secondary impacts would be anticipated after control by these spiders. A limited number of egg cases could be obtained this spring on a test basis only.

4. Cultural Control

The basic premise of pest control through cultural methods is that pest populations will not increase to serious levels where environmental conditions do not favor the pest over other members of the community. Cultural practices that promote an ecological balance provide excellent protection from infestation. Generally, in areas where infestations are a potential detriment, an ecologically balanced environment has been altered in some manner. Conditions such as drought, fire, monovegetative seedings, and poor rangeland conditions are favorable to grasshopper development (Hewitt 1977; Campbell et al. 1974; Holmes et al. 1979; Anderson 1973; Knutson and Campbell 1976). It should be noted that some infested areas do not have these characteristics. The only cultural controls available to prevent serious depletion of the vegetation would be the removal or reduction of herbivores and/or the implementation of improved range management through better grazing systems, contour furrowing, etc. In an emergency situation, a total removal of all domestic stock would be possible but somewhat unrealistic.

The time required to return the range to an ecological balance would be a long-term undertaking at best and provide little or no relief of the current infestation potential. The threat of mass migratory movements before balance is restored would also exist if natural climatic and biological processes did not control infestations.

Long-term cultural control is probably the only viable method available that would serve as an overall solution to this potentially annual situation. A gradual reduction in vegetation use over several years until the ecosystem vigor was regained may eliminate the risk of periodic grasshopper population eruptions and thus the need for an annual large-scale control program.

This alternative could only be implemented following the completion of environmental impact statements on grazing or the negotiating of informal agreements with individual ranchers.

The cultural control alternative is not considered viable on USFS lands since its implementation would have unacceptable negative impacts on family ranches and the local socioeconomic community.

National, regional, and Humboldt National Forest direction is quite specific. USFS policy emphasizes range management programs that serve the needs of family ranches; improvement, maintenance, and development of the range resource to its reasonably attainable potential; and optimization of the

production and use of forage on all suitable range to the extent that it is cost effective to do so (FSM 2202 item 1, a, b, c; FSM 2203 items 4 and 5; FSM 2203.1-especially item 9 under section II; Range Management Goals Supplement No. 58; and Mountain City Multiple Use Plan, Intermediate Zone, Management decision No. 13, page 33).

5. Integrated Pest Management (IPM)

The IPM system combines chemical, biological, and cultural methods for an environmentally sound reduction of pest populations. Chemical use could be employed as stated in the proposed action but limited to areas where resulting environmental impacts would be minimal. Target selective biological agents, discussed under Biological Controls, would be used in all sensitive areas. Cultural practices to prevent further outbreaks would be initiated after treatment with chemical or biological controls.

II. Existing Land Use Plans

After consulting with all agencies involved, no direct conflict of any land use plans has been found within the infested boundaries delineated to date. Normally, pest control is not addressed in land use planning.

III. Affected Environment

A. Nonliving Components

1. Topography and Climate

The topography of northern Nevada consists of numerous north to south-trending mountain ranges separated by broad, flat valleys or rolling hills. There is an abrupt change of slope at the base of the mountains and adjoining alluvial aprons.

The majority of the area is drained by the Humboldt River, terminating at the Humboldt Sink. A sizable portion drains north into the Columbia River System, and a smaller area in the east is part of the Salt Lake Basin. There are also many smaller closed drainage basins, e.g., Ruby Marshes. Elevations range from 3,790 feet (1,155 meters) at Pyramid Lake to 11,390 feet (3,472 meters) on Ruby Dome.

The climate of northern Nevada is typical of the intermountain west. Its characteristics include a predominantly dry climate, wide ranging daily and seasonal temperatures (-40 degrees F. in winter to 100 degrees F.+ in summer), and infrequent but severe storms. The mean annual precipitation varies, due to elevation, from about 40 inches (100 cm) at higher elevations to 4 inches (10 cm) or less in the Carson Sink. Prevailing winds are from the southwest and average about 6 to 8 miles per hour (10 to 13 km/hr). Most moisture for storms comes from the Pacific Ocean, producing winter snows and spring rains. Thunderstorms are a frequent summer event due to Great Basin lows, but they produce a relatively small percentage of the total precipitation for any one year. The cold, wet mountainous areas often contrast strikingly with the semiarid valleys, resulting in a highly complicated climatic pattern (Houghton et al. 1975).

2. Air

Northeastern Nevada has good air quality, with occasional, localized occurrences of dust caused by high winds, vehicular traffic, and construction activities. Local fires sometimes cause a reduction in visibility in limited areas.

3. Soils

Due to the varied climate, soil types are also quite variable. In mountainous regions and valleys, soils are often quite deep. In semiarid zones the shortage of water tends to decrease the rate of weathering, so soils are thin. Many valleys have flat areas where water may stand at times and where fine-grained deposits accumulate, resulting in the formation of saline clay soils. However, soil textures are generally loams, clay loams, sandy loams, and silt loams, most of which are capable of supporting vegetation. The most common soil orders are mollisols, aridisols, and entisols, with erosion susceptibility varying from slight to moderate.

4. Water

Runoff from mountain ranges provides the major source for the streams and rivers of the area. Precipitation adds significantly to the ground water reservoirs in the valleys. The ground water resources tapped by wells provide water for domestic use, irrigation of crops, and livestock.

Surface water resources which provide water for domestic use, livestock, wildlife, and recreation consist of rivers, streams, ponds, reservoirs, springs, and seeps. The quality of these waters is variable, and they are quite often polluted by concentrations of livestock in or near surface water sources. Deterioration of watershed vegetative cover has led to increases in sediment loads. any source?

B. Living Components

1. Vegetation

a. Terrestrial

For the purpose of this discussion, it is not practical to list all the terrestrial plant species that exist in northern Nevada. However, ten broad plant communities are recognized, with their major components identified as follows:

(1) Meadows

This type occurs along perennial streams, stream terraces, and valley bottoms and around localized seeps and springs. Slope gradients are mostly 0 to 4 percent but may vary between 0 to 15 percent. Elevations are 4,000 to 8,000 feet (1,200 to 2,400 meters).

This plant community is dominated by tufted hairgrass (*Deschampsia caespitosa*). Nevada bluegrass (*Poa nevadensis*), big bluegrass (*Poa ampla*), alpine timothy (*Phleum alpinum*), carpet clover (*Trifolium monanthum*), and meadow sedges (*Carex* spp.) are important plants associated with this type. Potential vegetative composition is about 70 percent grasses, 25 percent forbs, and 5 percent shrubs.

High water tables and/or seasonal flooding may cause small marshlike habitats to develop in depressions and basins within the site. Vegetation characteristic of these wetland areas includes cattails, bulrushes, spike rushes, reedgrass, and water-loving sedges. Where these shallow marshes are of limited extent, they are recognized as inclusions within this type.

(2) Big Sagebrush

The most extensive community in the area, this type occurs on terraces, alluvial fans, and low rolling hills on all exposures. Slopes range from 2 to 50 percent but slope gradients of 4 to 15 percent are most typical. Elevations are from 4,000 to 6,000 feet (1,200 to 1,700 meters).

This plant community is characterized by Thurber needlegrass (Stipa thurberiana), bluebunch wheatgrass (Agropyron spicatum), and Wyoming big sagebrush (Artemisia tridentata subsp. wyomingensis). Indian ricegrass (Oryzopsis hymenoides). Basin wildrye (Elymus cinereus), bottlebrush squirrel tail (Sitanion hystrix), Sandberg bluegrass (Poa sandbergii), pine bluegrass (Poa scrabrella), arrowleaf balsamroot (Balsamorhiza sagittata), and tapertip hawksbeard (Crepis acuminata) are important herbaceous species associated with this site. Potential vegetative composition is about 50 percent grasses, 15 percent forbs, and 35 percent shrubs.

(3) Low sagebrush

This type occurs on high mountain ridges, mountain side slopes, and plateaus. Slopes range from 4 to 75 percent but slope gradients of 15 to 50 percent are most typical. Elevations are 5,000 to 9,500 feet (1,500 to 3,000 meters).

This plant community is characterized by Idaho fescue (Festuca idahoensis), low sagebrush (Artemisia arbuscula), and black sagebrush (Artemisia nova). Black sagebrush is common from low arid foothills and ranges to high mountain ridges. Low sagebrush is most common in foothills and on mountain slopes above 6,000 feet. In some areas, the dwarf sagebrushes are intermingled with severely stunted big sagebrush (Artemisia tridentata). Other important grasses are Webber ricegrass (Oryzopsis webberi), bottlebrush squirrel tail (Sitanion hystrix), Cusick bluegrass (Poa cusickii), sandberg bluegrass (Poa secunda), and pine bluegrass (Poa scabrella). Potential vegetative composition is about 50 percent grasses, 15 percent forbs, and 35 percent shrubs.

(4) Mountain brush

This type occurs on upland terraces and inset mountain valleys and slopes of all aspects. Slopes range from 4 to 50 percent, but are mostly about 30 percent. Elevations are 6,000 to 9,000 feet (1,800 to 2,550 meters).

The plant community is characterized by Idaho fescue (Festuca idahoensis), bluebunch wheatgrass (Agropyron spicatum), and snowberry (Symphoricarpos spp.). Mountain brome (Bromus carinatus), oceanspray (Holodiscus discolor), curlleaf mountain mahogany (Cercocarpus ledifolius), mountain big sagebrush (Artemisia tridentata subsp. vaseyana) are other important species associated with this site. Brush species dominate the area. Potential vegetative composition is about 55 percent grasses, 15 percent forbs, and 30 percent shrubs.

(5) Pinyon-Juniper Woodland

This type occurs in mountainous regions. Slopes range from 30 to 50 percent, but slope gradients of 30 percent are most typical. Elevations are 5,500 to 9,000 feet (1,700 to 2,550 meters).

This plant community is characterized by Pinyon Pine (Pinus monophylla) and/or Utah juniper (Juniperus osteosperma), bluebunch wheatgrass (Agropyron spicatum), and black sagebrush (Artemisia nova). Thurber needlegrass (Stipa thurberiana), Sandberg bluegrass (Poa sandbergii), Basin wildrye (Elymus cinereus), and needle and thread grass (Stipa comata) are important species associated with this site. Juniper and pinyon trees are prevalent enough to dominate these areas; however, bitterbrush (Purshia tridentata) and curlleaf mountain mahogany (Cercocarpus ledifolius) can be located within the understory. Potential vegetative composition is about 40 percent grasses, 15 percent forbs, and 45 percent shrubs and trees.

(6) Broadleaf trees

Many areas in the mountains have small stands of aspen (Populus tremuloides) and/or cottonwood (Populus spp.). The understory consists of forbs, e.g., aster, lupine, fireweed (Epilobium spp.), and (Geranium spp.), but is often

dominated by snowberry. Some common grasses which may be present are California brome, slender wheatgrass (*Agropoyron trachycaulum*), and blue wildrye (*Elymus glaucus*).

Willows (Salix spp.) often occur in stands along streams. The understory here usually contains many of the forbs and grasses common in meadows.

(7) Shadscale

This type occurs on alluvial terraces, fans, and foothills on all aspects. Slopes range from 0 to 30 percent but slope gradents of 0 to 8 percent are most typical. Elevations are 4,000 to 5,800 feet (1,200 to 1,800 meters).

The plant community is characterized by shadscale (*Atriplex confertifolia*) and bud sage (*Artemisia spinescens*). Squirrel tail (*Sitanion hystrix*) and Indian ricegrass (*Oryzopsis hymenoides*) are important species associated with this type. Potential vegetative composition is approximately 10 percent grasses, 5 percent forbs, and 85 percent shrubs.

(8) Greasewood

This type occurs on floodplains and closed-basin bottomlands adjacent to playas. Slopes range from 0 to 2 percent. Elevations are 4,000 to 6,000 feet (1,200 to 1,800 meters).

This plant community is characterized by black greasewood (*Sarcobatus vermiculatus*). Vegetation in this type is normally restricted to coppice mound areas that are surrounded by playa-like depressions or nearly level, usually barren, interspaces. Basin wildrye (*Elymus cinereus*) and inland saltgrass (*Distichlis spicata* var. *stricta*) are the most prevalent herbaceous species associated with this type. Saltgrass may extend into the interspace zone in some areas. Potential vegetative composition is about 25 percent grasses, 5 percent forbs, and 70 percent shrubs.

(9) Winterfat

This type occurs on alluvial fans and terraces on all aspects. Slopes range from 2 to 30 percent, but slope gradients of 4 to 15 percent

are most typical. Elevations are 4,000 to 6,000 feet (1,200 to 1,800 meters). This plant community is characterized by winterfat (Eurotia lanata) and bud sagebrush (Artemisia spinescens). Shadscale (Atriplex confertifolia), Indian ricegrass (Oryzopsis hymenoides), and bottlebrush squirrel tail (Sitanion hystrix) are important species associated with this type. Potential vegetative composition is about 20 percent grasses, 5 percent forbs, and 75 percent shrubs.

(10) Annuals

Areas that are burned or overgrazed may be invaded by annual weeds, sometimes nearly to the exclusion of native species. Dominant plants in this type are usually downy brome or halogeton. Other plants often present in these areas are Sandberg's bluegrass (Poa sandbergii), Russian thistle (Salsola kali tenuifolia), clasping pepperweed (Lepidium perfoliatum), and tumble mustard (Sisymbrium altissimus).

In addition to the above identified native plant communitites, there are large areas of crested wheatgrass (Agropyron cristatum) seedings.

b. Aquatic and Riparian

The major aquatic and riparian plants in northern Nevada are willow, rose, cattail (Typha latifolia), coontail (Ceratophyllum spp.), lovegrass (Eragrostis spp.), monkey flower, pondweed (Potamogeton spp.), rabbitfoot grass (Polypogon monspeliensis), spike rush (Eleocharis spp.), stinging nettle (Urtica dioica), water buttercup (Ranunculus aquatilis), and watercress (Rorippa nasturtium-aquaticum).

Other aquatic and riparian species are present but occur infrequently. Algae are distributed throughout the streams. Some algae believed to be present are Vaucheria spp., Chaetophora elegans, Cladophora glomerata, and Prasiola nevadensis. Phytoplankton are also present.

2. Animals

In the project area there are approximately 85 species of mammals, 284 species of birds, and 39 species of reptiles and amphibians within the various habitat types. Of these more than 400 species, many are highly mobile, moving daily or seasonally over great distances, while others are restricted for their entire life cycles to just a few square yards. A complete listing of species for northern Nevada is available from the BLM offices in Elko, Battle Mountain, and Winnemucca and from the USFS and Nevada Department of Wildlife Office in Elko.

Only those animals which may be affected by the proposed action or any of the alternatives will be discussed here.

a. Mammals

Insectivorous mammals, primarily shrews and a variety of bats, occur in the project area. Mammalian predators such as coyotes (Canis latrans), foxes (Vulpes spp.), and bobcats (Felis rufus) are common. Large herbivores, primarily domestic livestock, wild horses, mule deer (Odocoileus hemionus), and pronghorn antelope (Antilocapra americana) occur throughout the area. Mule deer, pronghorn, and wild horses are more localized and spotty in their distribution, whereas livestock occur over the entire area.

b. Birds

Game birds, including chukar partridge (Alectoris chukar), Hungarian partridge (Perdix perdix), and Sage grouse (Centrocercus urophasianus); raptors, including a variety of buteos, accipiters, falcons and owls; and a wide range of passerine and other so-called nongame birds occur throughout the project area. Many of these species utilize insects partially or exclusively as a food source during their life cycles.

c. Reptiles and Amphibians

Common reptiles in the project area include insect-feeding lizards such as the side-blotched lizard (Uta stansburiana), sagebrush lizard (Sceloporus gracious), desert spiny lizard (S. magister), and short-horned lizard (Phrynosoma douglassi). Common insect-eating amphibians include the western toad (Bufo boreas) and Great Basin spade foot toad (Scaphiopus intermontanus). Several species of snakes in the area are known to feed on insects.

d. Invertebrates

(1) Terrestrial

Northern Nevada has representatives of most orders of insects and a wide variety of other invertebrate species such as arachnids, soil invertebrates, and protozoans. All invertebrates play essential roles in the maintenance of the environment by serving as primary sources of food for terrestrial and aquatic species, as decomposers and recyclers of nutrients in the soils, and as major predators of various other species of invertebrates. A large number of parasites and predators of grasshoppers are invertebrates. (See Appendix 4.)

In addition, many insects are necessary for the pollination, and therefore reproduction, of many plants, including important range forbs and shrubs. (See Appendix 5.)

A number of endemic species of insects have been found in unique habitats in this area. Three species of rare bees are now known to be pollinators of certain equally rare plants in northern Nevada.

A few examples of specific endemic insects in northern Nevada include the bees Andrena thorpi (Linsley and MacSwain 1962), Proteriades shosone (Parker 1976), and an undescribed Osmia sp. (Parker 1980, personal communication); the beetles Trogloderus nevadus (La Rivers 1942) and Crossidius hirtipes bechteli (Linsley and Chemsak 1961); and undescribed species of antlions (Parker 1979, personal communication). In The Biology and External Morphology of Bees (Stephens et al. 1969), the endemism of bees in the Great Basin is emphasized in the statement that in northwestern America, "Bees achieve their varietal maximum (greatest abundance of unique individual kinds) in the Great Basin region".

(2) Aquatic

The major orders of aquatic invertebrates present in northern Nevada are Amphipoda (scuds), Decapoda (crayfish), Gastropoda (snails), Isopoda (sow bugs), Pelecypoda (clams and

mussels), Coleoptera (water beetles), Diptera (flies), Ephemeroptera (mayflies), Hemiptera (backswimmers, water boatmen, and water striders), Odonata (dragon flies and damsel flies), Plecoptera (stone flies), and Tricoptera (caddisflies). All of these invertebrates are very important as members of the food web in their ecological community.

e. Fish

Many fish species are known to inhabit the waters of northern Nevada. These include three species of catfish (Ictaluridae), sixteen species of minnows (Cyprinidae), pike (Esox lucius), five species of sucker (Catastomidae), five species of sunfish (Centrarchidae), eight species of trout (Salmonidae), and two species of sculpin (Cottidae). (See attached maps for fishery stream locations.)

3. Endangered, Threatened, Rare, or Sensitive Species

a. Vegetation

One species of plant is currently federally listed as Endangered under the Endangered Species Act of 1973 as amended (Federal Register 8/13/80, pp. 53968-53970). This species, the Osgood Mountains milk-vetch (Astragalus yoder-williamsii), occurs in the northern end of the Osgood Mountains in eastern Humboldt County. Additionally, a number of other species are currently undergoing review for federal listing as Threatened and Endangered. A species of high priority for listing is the silver-leaf buckwheat (Eriogonum argophyllum), known to consist of only 75 individuals in Ruby Valley, Elko County. Also, four species are declared to be "threatened with extinction" in the project area and are protected by Nevada State Law (NRS 527.270). Appendix 6 lists those species of plants known to occur in the Elko, Humboldt, Lander, Eureka, and Pershing County area and recommended for threatened, endangered, or sensitive classification. Also listed are those species known as endemic but not sensitive.

b. Mammals

The spotted bat (Euderma maculatum) is presently listed as rare by the State of Nevada. It is known to live in northern Humboldt County, although its

habitat is considered to exist throughout northern Nevada (Burt and Gossenheider 1964).

c. Birds

The American peregrine falcon (*Falco peregrinus avatum*) and the bald eagle (*Haliaeetus leucocephalus*) are federally listed as endangered and threatened respectively. The peregrine is a seasonal migrant through the project area, while the bald eagle is a winter inhabitant.

d. Invertebrates

At the present time, there are no federal or state listed endangered or threatened invertebrates in the project area. However, there has been considerable recent interest by the entomological community concerning possible threats to endemic insect species, such as endemic bees and beetles. One species of bee of the genus *Osmia* is a newly discovered species, but the formal description is not yet complete. This bee is known only as the main pollinator of the federally listed endangered plant, *Astragalus yoder-williamsii*. A review of this and other endemic invertebrate species is needed to determine suitability for federal listing. An area of particular interest in regard to endemic insects is the Paradise Valley dune system of Humboldt County, where a number of endemic insects have been identified (Parker 1980, personal communication; Thorpe 1980, personal communication).

e. Fish

The Lahontan cutthroat trout (*Salmo clarki henshawi*) is federally listed as threatened, while the Clover Valley speckled dace (*Rhinichthys osculus oligoporus*) is a candidate species for federal listing. The Relict Steptoe dace (*Relictus solitarius*) and the red-banded trout (*Salmo* sp.) are listed by the state of Nevada as sensitive species. (See attached maps for known locations of threatened and sensitive fish species.)

C. Ecological Interrelationships

The ecological interrelationships are extremely complex when the entire ecosystem of northern Nevada is considered. Existing data is not sufficient to enable a detailed examination of the relationships among all the components of this community. For the purpose of this analysis, a discussion of the food

web and the importance of pollinating insects is appropriate.

Each species occupies a specific niche in the food web. Vegetation, the basic producer, is consumed by herbivores, which, in turn, become a food source for carnivorous species. Even the highest forms of animals, after death, provide food to lower forms, such as scavengers and reducer-decomposer organisms. When the web is in balance, producer, consumer, and reducer-decomposer populations maintain a dynamic equilibrium and each species is able to sustain a relatively stable, although fluctuating, population within the community.

However, if the balance is disrupted, some species may be favored while others are adversely affected. Such is the case with the migratory grasshopper. Ecological conditions such as drought, fire, monovegetative seedings, and poor range condition have favored the grasshopper. At the present time, grasshopper populations are believed to be increasing faster than the populations of their natural enemies (both predators and parasites).

The fall adult survey indicates that grasshoppers have reached economic proportions in many areas of northern Nevada. The grasshopper, a voracious feeder on many plants, may become a serious competitor with other grazing animals if natural systems or artificial methods do not limit its population.

When artificial control methods are employed, care must be taken to ensure that the foreign substance does not further disrupt natural systems. It is possible that life cycles could be altered to the point that some species might be eliminated from the community. Some plants are highly susceptible to elimination if their specialized insect pollinators are destroyed. Many plants in northern Nevada are dependent on insect pollinating systems for reproduction. (See Appendix 5.)

D. Human Values

The land and water resources of northern Nevada are highly valued in terms of economic and recreational use. They are an integral factor in the economic development and stability of the region as well as in the enjoyment of leisure time. For a more comprehensive analysis of the economic and recreational concerns, see Environmental Consequences (Chapter IV, Section 4).

IV. Environmental Consequences

The following analysis of environmental consequences is based on an extensive review of available literature concerning the effects of the proposed action and alternatives, information from specialists in the field, and the professional judgement of the authors.

A. Proposed Action

To assess the environmental impacts of a pest control project of the magnitude of the proposed action is difficult at best. The possible detrimental ecological effects of an insecticide application are amazingly complex, and few effects are mutually exclusive (Giles 1970). Impacts in many instances are very subtle and may even be undetectable. The basic effect is the reduction in efficiency of the ecosystem following reduced energy flow and nutrient cycling rates (Giles 1970).

1. Nonliving Components

a. Air: There would exist, on a temporary basis, a certain concentration of malathion or carbaryl in the air after spraying. While most of the chemical would reach the ground within seconds, some may remain airborne for as long as five hours (Dan Kail, personal communication). If the spraying were done too late in the day, an updraft could carry the chemical high into the air, from which it could be dispersed many miles from the original site. APHIS's careful monitoring of environmental conditions during application should prevent these problems.

b. Soil: Research findings to date give a strong indication that malathion or one of its breakdown products may adhere to soil particles for considerable periods of time (Bowman et al. 1970). Carbaryl may remain in soil for five months or more (Katan et al. 1976). The residual impacts are unknown at this time, but it can be stated that there is a potential for adverse impacts to microbial soil organisms.

c. Water: If pesticides were sprayed over water, the resulting water quality concentration would probably exceed state and federal (EPA) limits of 0.1 microgram/liter (0.1 ppb). Malathion in ultra-low volume concentrate (95%) applied at the rate of 3.0 fl. oz./acre resulted in maximum concentrations in surface waters of 0.5 ppm (500 ppb)

(Guerrant et al. 1970). There is no data in the literature on the concentrations to expect in water from aerial application of malathion at 8 fl. oz./acre. Concentrations would vary, depending on surface area of water exposed to spraying, stream volume, and stream velocity. Streams with good vegetative cover would be impacted less than exposed streams because plants would intercept a portion of the chemical before it reached the water surface.

The half-life of malathion in water is basically influenced by water temperature and pH -- increasing water temperature and increasing pH (above 4.0) reduce the half-life of malathion in water (Wolfe et al. 1977). Waters in the proposed spray areas are generally alkaline (pH 7.5-8.5). The literature indicates a half-life of 2 to 14 days in this pH range.

Spraying of Sevin 4 Oil over streams and standing bodies of water would result in Sevin reaching the water and contaminating it. In slightly acidic waters, Sevin would be stable and persist for long periods of time. On the other hand, with waters at pH 7.0 and 20 degrees C., Sevin would decompose slowly and the compound would be almost completely hydrolyzed (99 percent) in about 70 days. At a pH of 8.0, complete hydrolysis would be achieved in 9 days (Aly et al. 1971). Carbaryl bait would also result in toxic contamination if applied to water.

Label instructions for each of these pesticides states that direct application to water should be avoided.

2. <u>Living Components</u>

a. Vegetation

(1) Terrestrial

This action would result in a segment of the herbivorous insect population being removed from the control areas. Consequently, vegetation which would have otherwise been consumed or damaged would be conserved.

Damage sustained by plant foliage from direct application of malathion or ground application of carbaryl bait at the proposed rate would be negligible. The effect of the aerial application of the carbaryl/ diesel oil mixture is

not known, but it could damage the portions of the plants contacted. No permanent damage to perennial plants is anticipated. The reproductive cycle of some plants may be inhibited because of a decrease in pollinating insects.

(2) Aquatic

Aquatic plants are not likely to be impacted.

b. Animals

(1) Mammals

The reduction in arthropod populations may have a direct impact on insectivorous mammals such as shrews and bats through a decreased food supply. Bats would be less affected since they are capable of moving to nonspray areas to feed.

Large mammals would not be directly impacted. Predators (coyotes, foxes, bobcats, etc.) may have an increased food supply available immediately after treatment as prey species, especially birds, suffered impaired reflexes for a short time due to sub-lethal secondary poisoning.

Herbivores would have a greater food supply because of a decreased use of forage by grazing insects. Vegetative cover for all wildlife would improve as destruction of it by grasshoppers decreased.

(2) Birds

Birds would be most impacted by significant reductions in invertebrate populations. Grasshoppers, as well as other insects, are important in the diet of over 120 species of birds (McEwen et al. 1972). Young gallinacious birds such as sage grouse, chukar, and Hungarian partridge are heavily dependent on insects during the first few weeks of life. Insects, including grasshoppers, beetles, and ants, account for 52 to 60 percent of the diet of one-week-old sage grouse chicks but decline in importance thereafter (Klebenow 1968; Braun et al. 1977). Wiegand (1980) cites reports of insects comprising 52 to 95 percent of the diet of Hungarian partridge chicks one to four weeks old. Chukar partridge dependence on insects is similar to that of

sage grouse (Alcorn and Richardson 1951), although adult chukars also utilize insects to a small extent (Christensen 1970).

It is not expected that any of these game birds would move out of a spray area since the adults are not totally dependent on insects for food. However, development of chicks could be impaired because of the reduced insect population as a food source.

Nongame insectivorous birds may be impacted by being forced to move out of spray areas in search of food. McEwen et al. (1964) found that bird numbers notably decreased in malathion sprayed areas and increased in the adjacent unsprayed areas by 57 percent. This could result in increased stress being placed on the resident population in adjacent unsprayed areas by the influx of birds fleeing sprayed areas in search of food.

Spraying of large areas during nesting season could cause a disruption of nesting activity. Nests may be abandoned by parents forced to travel great distances to find food. This could result in a complete loss of reproduction for the year.

While no evidence is found to suggest that birds would ingest enough contaminated food or insecticide itself to cause death, studies indicate that they could be more susceptible to predation because of impaired reflexes resulting from sublethal doses of malathion or carbaryl (McEwen and Brown 1966; Meydani and Post 1979). The same studies indicate that this impairment of physical activity could disrupt food gathering and reproductive behavior.

Although raptors in general are not expected to be adversely impacted, the Swainson's hawk could be affected. Due to an existing, downward, long-term population trend, the fact that this bird is a primary grasshopper consumer, and the expectation that there would be young birds in the nest during the application period, adverse impacts would be possible.

(3) Reptiles and Amphibians

Some reptiles and amphibians may suffer a food shortage because of reduced invertebrate populations.

(4) Invertebrates

(a) Terrestrial

Both malathion and carbaryl are broad-spectrum insecticides. Studies have shown that in addition to killing target insects, in this case grasshoppers and Mormon crickets, both substances are lethal to other groups of arthropods. These include Hymenoptera (bees, wasps, and ants), Diptera (flies and gnats), Hemiptera (true bugs), Coleoptera (beetles), Homoptera (cicadas and aphids), Araneae (spiders), and Odonata (dragon flies and damsel flies) (Alvarez et al. 1970; Giles 1970; Hill et al. 1971; Urbauer and Pruess 1973; Suttman and Barrett 1979).

Wide area application of malathion would result in a significant decrease in insect populations. Table 1 lists arthropods which would be significantly impacted by malathion spraying. Both malathion and carbaryl could be expected to reduce grasshopper and Mormon cricket populations up to 85 percent. The effect of the spray on nontarget insects would be in the range of 30 to 90 percent reduction for most insect populations and would approach a 100 percent reduction for bee populations. (Urbauer and Pruess 1973; Suttman and Barrett 1979). The decrease in insect populations may be temporary or long term, depending on the recovery rate of the various groups affected.

The toxicity of the various proposed control agents depends on the invertebrate group involved. Malathion would be toxic to bees on contact. Carbaryl/Sevin 4 Oil would be highly toxic as a stomach poison. It would not kill bees on contact but would be transported back to the hive or burrow, where it could kill the entire population (Shay 1980, personal communication). Carbaryl bait has "zero hazard to bee species" (Johansen 1980, personal communication) but could be highly toxic to ant species as well as the target species. A significant kill to honey bees can remain up to four or five days after application of ULV Malathion and up to a week after application to wild bee species (Johansen 1980, personal communication.)

TABLE 1

ARTHROPODS AGAINST WHICH MALATHION IS EFFECTIVE[1]

Alafalfa caterpillar	Colias eurytheme
Alafalfa looper	Autographa californica
Alfalfa weevil	Hypera postica
Ants	Family Formicidae
Aphids	Family Aphididae
Armyworm	Pseudaletia unipuncta
Asparagus beetle	Crioceris asparagi
Bagworm	Thyridopteryx ephemeraeformis
Bed bug	Cimex lectularis
Beet leafhopper	Cruculifer tenellus
Birch leafminer	Fenusa pusilla
Blackheaded fireworm	Rhopobota naevana
Blueberry fruit fly	Rhagoletis mendax
Body lice	Pediculus humanus humanus
Boxwood leafminer	Monarthropalpus buxi
Brown cotton leafworm	Acontia dacia
Brown dog tick	Rhipicephalus sanguineus
Cabbage looper	Trichoplusia ni
Carpet beetle	Anthrenus scrophulariae
Cat flea	Ctenocephalides felis
Caterpillars	Order Lepidoptera
Celery looper	Anagrapha falcifera
Centipedes	Class Chilopoda
Cereal leaf beetle	Oulema melanopus
Cherry fruit fly	Rhagoletis cingulata
Cherry fruitworm	Grapholitha packardi
Chigger	Family Trombiculidae
Cigarette beetle	Lasioderma serricorne
Cloths moths	Family Tineidae
Clover leaf weevil	Hypera punctata
Cockroaches	Order Dictyoptera
Codling moth	Lasperresia pomonella
Confused flour beetle	Tribolium confusum
Corn earworm	Heliothis zea
Corn rootworm	Diabrotica spp.
Cotton leafperforator	Bucculatrix thurberiella
Cotton leafworm	Alabama argillacea
Cranberry fruitworm	Acrobasis vaccinii
Cucumber beetle	Family Chrysomelidae
Diamondback moth	Piutella xylostella
Darkwinged fungus gnat	Family Sciaridae
Dog flea	Ctenocephalides canis
Driedfruit beetle	Carpophilus hemipterus

SOURCE: American Cyanamid Co., CYTHION - Manual of Label Claims for Insect Control

[1]Malathion is also effective against other species. This list only shows species for which the pesticide is recommended.

Table 1. (Continued)

Drosophila	Family Drosophilidae
Earwigs	Family Dermaptera
European pine sawfly	*Neodiprion sertifer*
European pine shoot moth	*Rhyacionia buoliana*
Eyespotted budmoth	*Spilonota ocellana*
Fall armyworm	*Spodoptera frugiperda*
False chinch bug	*Nysius ericae*
Flat grain beetle	*Cryptolestes pusillus*
Flea beetles	Family Chrysomelidae
Fourlined plant bug	*Poecilocapsus lineatus*
Fruit flies	Family Tephritidae
Truittree leafroller	*Archips argyrospilus*
Garden webworm	*Loxostege rantalis*
Granary weevil	*Sitophilus granarius*
Grape phylloxera	*Phylloxera vitifoliae*
Grasshoppers	Family Acrididae
Greenbugs	Aphididae
Green cloverworm	*Plathypena scabra*
Greenhouse thrip	*Heliothrips haemorrhoidalis*
Green stink bug	*Acrosternum hilare*
Ground pearl	Family Margarodidae
Harlequin bug	*Margantia histrionica*
Head lice	*Pediculus humanus capitis*
Hemlock looper	*Lambdina fiscellaria*
Horn fly	*Haematobia irritans*
Indian meal moth	*Plodia interpunctella*
Imported cabbageworm	*Pieris rapae*
Imported currentworm	*Nematus ribesii*
Japenese beetle	*Popillia japonica*
Khapra beetle	*Trogoderma granarium*
Lace bugs	Family Tingidae
Larch casebearer	*Coleophora laricella*
Leafhoppers	Family Cicadellidae
Lesser grain borer	*Rhyzopertha dominica*
Lesser peach tree borer	*Synanthedon pictipes*
Lice	Orders Anoplura/Mallophaga
Lygus bugs	*Lygus* spp.
Mealybugs	Family Pseudoccccidae
Mediterranean fruit fly	*Ceratitis capitata*
Mexican bean beetle	*Epilachna varivestis*
Milipedes	Class Diplopoda
Mites	Order Acarina
Morningglory leafminer	*Bedellia somnulentella*
Mosquitoes	Family Culicidae
Nitidulid beetles	Family Nitidulidae
Northern fowlmite	*Ornithonyssus sylvarum*
Oak kerms	*Kermes pubescens*
Omniverous leaftier	*Cnephasia longana*
Omniverous looper	*Sabulodes caberata*
Onion maggot	*Hylemya antiqua*
Orange tortrix	*Argyrotaenia citrana*

Table 1. (Continued)

Oriental fruit moth	*Grapholitha molesta*
Otodectic mange mites	*Otodectes* spp.
Peach twig borer	*Anarsia lineatella*
Pea weevil	*Bruchus pisorum*
Pear psylla	*Psylla pyricola*
Pecan bud moth	*Gretchena bolliana*
Pecan leaf casebearer	*Acrobasis juglandis*
Pecan nut casebearer	*Acrobasis nuxvorella*
Pecan phylloxera	*Phylloxera devastatrix*
Pepper maggot	*Zonosemata electa*
Phorid flies	Family Phoridae
Pickleworm	*Diaphania nitidalis*
Plum curculio	*Conotrachelus nenuphar*
Potatoe leafhopper	*Empoasca fabae*
Redbanded leafroller	*Argyrotaenia velutinana*
Red flour beetle	*Tribolium castaneum*
Rice leafminer	*Hydrellia griseola*
Rice stinkbug	*Oebalus pugnax*
Rice weevil	*Lissorhoptrus oryzophilus*
Rose leafhopper	*Edwardsiana rosae*
Rusty grain beetle	*Cryptolestes ferrugineus*
Sap beetle	Family Nitidulidae
Saratoga spittlebug	*Aphrophora saratogensis*
Sarcoptic mange	Family Sarcoptidae
Sawtoothed grain beetle	*Oryzaephilus surinamensis*
Scales	Superfamily Coccoidea
Scorpions	Order Scorpionida
Shaft lice	*Menopon gallinae*
Sharpnosed leafhopper	*Scaphytopius magdalensis*
Sheep ked	*Melophagus ovinus*
Silverfish	*Lepisma saccharina*
Soft scales	Family Coccidae
Sorghum midge	*Contarinia sorghicola*
Spiders	Order Araneida
Spittlebugs	Family Cercopidae
Spruce budworm	*Choristoneura fumiferana*
Squash vine borer	*Melittia cucurbitae*
Strawberry leafroller	*Ancylis comptana*
Strawberry root weevil	*Otiorhynchus ovatus*
Sugarbeet root maggot	*Tetanops myopaeformis*
Tarnished plant bug	*Lygus lineolaris*
Tent caterpillar	*Malacosoma* spp.
Thrips	Order Thysanoptera
Ticks	Order Acarina
Unspotted tentiform caterpillar	*Parornix geminatella*
Vetch bruchid	*Bruchus brachialis*
Walnut husk fly	*Rhagoletis completa*
Western yellowstriped armyworm	*Spodoptera praefica*
Whiteflies	Family Aleyrodidae
Yellownecked caterpillar	*Datana ministra*

The actual number of insects killed, including target species, depends on several factors, including climate and vegetation in the spray areas. For example, the heavier the vegetation cover, the more protection from the spray provided to insects (Pfadt et al. 1970).

(b) Aquatic

Malathion is very toxic to aquatic invertebrates; there would be a significant reduction in aquatic invertebrates as a result of the treatment. Generally, the reduction would be marked but recovery would occur fairly rapidly (Giles 1970; Mulla et al. 1979; Midwest Research Institute 1975). Since there are differences in susceptibilities, there would probably be a temporary change in population structure due to the spraying. The speed of recovery to preapplication balance would probably be slower in areas of extremely large spray blocks due to the lack of adjacent unsprayed areas to form a source of recolonization.

Sevin 4 oil would also be very toxic to aquatic invertebrates, the results being similar to malathion spraying. Carbaryl bait application, if allowed to enter the water, would have the same effect (USDA 1972).

(5) Fish

Direct mortality of fish as a result of spraying with malathion could occur. Direct mortality has been documented in the 1979 Oregon grasshopper control program and the 1966 grasshopper control program on the Dixie National Forest, Utah (USDI 1967). In both cases, the mortality was localized to a few places; many other streams in the Oregon project showed no direct mortality. Fish that were killed in these projects were in the same stream portion with many others that did not experience direct mortality. In some instances, the direct fish kills occurred in areas where double spray swaths were observed (USDI 1967).

Malathion spraying as proposed would certainly cause aquatic invertebrate mortality. Most

aquatic insects are much more sensitive to malathion than fish. This effect on aquatic insects would reduce the food supply available to the fish, at least temporarily. Whether this reduction would be sufficient to stress the fish due to insufficient food supply is not known; however, it is a possiblity.

Sublethal effects on fish from the proposed spraying is another concern. The major sub-lethal effect on wild-ranging fishes would be the reduction of acetylcholinesterase (AChE) reserves, which would, in turn, bring about the inability of body muscles to perform properly. Fish with reduced AChE reserves would probably be unable to maintain a normal upright position in the water, resulting in uncontrolled drifting, inability to protect themselves from predation, beaching, or other hazards.

Brook and rainbow trout with AChE levels reduced approximately 75 percent showed a 71 percent reduction in their ability to perform physical work as compared to nonexposed fishes (Post 1974). Data indicates that approximately 20 to 30 percent of stored AChE can be lost by rainbow trout and coho salmon with a loss of less than 5 percent of their physical abilities (40-60 ppb malathion). The time taken to recover normal (nonexposed) AChE levels from the most depleted levels were 25 days for brook trout and 35 days for rainbow trout (Post 1974). It appears that fish exposed to levels of malathion in the water greater than 40-60 ppb may experience sublethal effects which could cause secondary mortality for a period of 25 to 35 days.

Fish exposed to malathion showed the highest concentrations of malathion in the liver, with flesh, blood, gills, and brain following in order of decreasing concentration. Retention times were very short, 12 hours being the average half-life of the residue (Bender 1968).

Streams with low stream gradients, low velocities, large areas of slow or standing water, shallow depth, and lack of shielding riparian vege-tation would be expected to experience the greatest impact from the proposed spraying of malathion.

The direct fish mortalities that have occurred from past malathion sprayings have been significant but not massive or total. Furthermore, they occur only in some streams, with others showing no direct mortality. Secondary mortality is not well documented but could occur for a relatively short time after spraying. Fish that were exposed to malathion would rid themselves of the residues quickly.

Sevin-4 Oil spraying should result in very little, if any, direct fish mortality. The acute toxicity of Sevin is much less than malathion. There would be a significant reduction in aquatic invertebrates and a possible stress to fish due to inadequate food supplies.

Sublethal effects are not as well known. However Sevin is also an acetylcholinesterase inhibitor and would be expected to have the same effects on muscle function as malathion. It is extremely difficult to establish the effects of sublethal dosages of carbaryl on physiological parameters in short-term test exposures simply because strong response levels are obtained only in concentrations yielding 30 to 60 percent mortality (Lunn et al. 1976). Spraying directly over a trout stream in Oregon with Sevin produced aquatic invertebrate mortality but no fish mortality (Irv Jones, personal communication). The concentration of spray in this instance is not known.

Carbaryl bait application should have the same effect on fish as Sevin application if it gets in the water, the severity depending on the application rate.

c. Endangered, Threatened, Rare or Sensitive Species

(1) Vegetation

Use of malathion or carbaryl/Sevin could seriously impact pollination systems of sensitive plant species where specialized pollinator/ plant relationships exists (Tepedino 1979). One documented example is the federally listed endangered Astragalus yoder-williamsii and the bee species (Osmia sp.), not yet been formally described, which is its primary pollinator.

Carbaryl bait would have no effect on the unique pollination system of sensitive plant species, except for cases, if any, involving ant pollination. Little is known of the mechanisms for pollination of the majority of sensitive plants in the project area.

(2) Mammals

The spotted bat feeds almost exclusively on small moths (Easterla 1965; Snow 1974). The proposed action could decrease this food supply, causing the bats to move to unsprayed areas to forage. Spotted bats have been known to travel several miles to feed (Easterla 1965); this should enable them to continue normal feeding habits outside sprayed areas.

(3) Birds

Neither the peregrine falcon nor the bald eagle are expected to be impacted by the proposed action.

(4) Invertebrates

The proposed action involving Malathion and carbaryl/Sevin could cause the loss of endemic or sensitive invertebrate species if they were out during the application periods. This is especially true of the wild bee species (Tepedino 1979).

Carbaryl bait would not have an effect on most invertebrates but could impact ants, including endemic populations. Little is known of the endemism of ants in the project area.

(5) Fish

If direct application of a pesticide should occur, mortality of fish may occur; however, loss of a complete population is unlikely. Other sublethal effects described for aquatic living components would also be possible.

3. Ecological Interrelationships

The application of malathion on large tracts of land would have a much greater affect on the ecosystem than would the same treatment on small areas.

The proposed action, conducted under favorable conditions, would effectively reduce the target insect population. However, the introduction of malathion

into the ecosystem would also affect the other members of the community. Most notably, the populations of other invertebrates would be decreased. Studies conducted by Urbauer and Preuss (1973) showed invertebrate deaths from ULV malathion application in Nebraska. Their findings, expressed as a percentage of the total population, showed mortality rates of 80 percent for spiders, 90 percent for insects in the order Hemiptera (true bugs), 52 percent for Orthoptera (grasshoppers, crickets, and cockroaches), and 32 percent for Coleoptera (beetles). These studies indicate a significant alteration in the insect portion of the food web and a varying tolerance among different species for malathion.

Malathion has limited water solubility (145 ppm at 25 degrees C.); however, it undergoes hydrolysis to form other compounds. One study indicates the basic hydolytic product, diethyl fumerate, is more toxic to aquatic life than malathion (Bender 1969). In addition, a pronounced synergistic effect can be demonstrated between malathion and its two hydrolytic products (Bender 1969). Studies conducted by USDI (1966) and Stucky (1975) indicate high mortality rates for aquatic insects following a ULV malathion treatment. The rate of dead insects floating downstream (drift organisms) was determined both before and after spraying. Postspray drift organism increases of 6,000, 2,000 and 15,000 percent were noted for stoneflies, mayflies, and caddisflies, respectively.

As discussed previously, birds and fish would be most directly impacted by massive reductions in invertebrate numbers. Insects account for 52 percent of the diet of sage grouse chicks during their first week of life (Klebenow 1968). Alcorn and Richardson (1951) reported finding chukar partridge dependence on insects that was similar to that of sagegrouse.

In general, nearly all bird species require a high protein diet, much of which is composed of invertebrates (Welty 1962). Even slight deficiencies in protein in bird diets have been found to inhibit growth, maturity, and reproduction. Some raptors would also migrate away from treated areas to follow their food source.

Spraying of large areas during nesting season could possibly result in an interruption of the reproduction cycle. Nests may be abandoned by parents forced to travel great distances to find food. In addition, increased stress would be placed on

the resident population in the adjacent areas by the influx of birds fleeing the sprayed areas in search of food.

Fish would also suffer from a food shortage. However, unlike birds, their opportunity to migrate would be limited. Trout are extremely dependent on invertebrates throughout their life cycle; if adequate supplies are not available, their ability to overwinter, combat disease, and avoid predation could be severely diminished.

Another ecological consideration would be the effect of malathion on the higher animal forms, specifically direct and secondary poisoning. While at the ULV rate of application there is little chance of exceeding toxic levels of malathion in the higher animal species, secondary poisoning is a distinct possibility.

Even though no evidence has been found to suggest that birds and small mammals would ingest enough contaminated food to cause death, studies indicate that they would be more susceptible to predation because of impaired reflexes (McEwen and Brown 1966; Giles 1970).

Although the vegetative resource seems to be favored by the proposed action, the reproductive cycles of some plants would be adversely affected if pollinator populations were significantly decreased (Johansen 1977). It is possible that some sensitive plants could totally lose their capacity to reproduce (Proctor and Yeo 1972).

4. Human Values

There are important economic, recreation and land-use values to be taken into consideration. The following describes these concerns and how they could be affected by the proposed action.

The major economic consideration is the forage loss that may be realized if spring conditions favored the development of the migratory grasshopper (Melanoplus sanguinipes). At the economic infestation rate of eight grasshoppers per square yard, it is estimated that grasshoppers could consume as much as 112 pounds of air-dry vegetation per acre during their life cycle (average from Parker 1930 and Randell 1972).

Research literature is in general agreement that M. sanguinipes is an nonspecific feeder. Although it exhibits preferences in different habitats, it tends to be opportunistic.

The 112 pounds per acre figure illustrates that this grasshopper is a serious competitor with other herbivorous animals. Forage consumption by grasshoppers could exceed the available forage allowed for all herbivores combined. In addition, there is concern that grasshoppers would migrate onto adjacent cropland when range vegetation was depleted. Although this does not directly affect the public land resource, it is part of the total economic picture.

The estimated cash value of the livestock forage on the 421,480 infested acres of BLM, USFS, and BIA administered land is approximately $327,911 (calculated at an AUM fee value of $7.88[1]). The estimated cash value of the livestock forage on the 260,520 acres of private land is approximately $405,369 (calculated at an AUM fee value of $7.88). If this total cash value of $733,280 were taken from the local economy by grasshopper infestation, there would be a subsequent loss of income and employment in the ranching industry.

This loss in income and employment would create a ripple effect in the local economy, as a portion of the lost money would normally be retained locally through numerous rounds of spending by individuals, businesses, and local government. Thus, the total loss to the local economy due to grasshopper infestation would be considerably higher than just the estimated AUM forage value.

Another method of stating the value of this infested acreage is by hypothesizing a total loss of forage from grasshoppers, thus necessitating the total replacement cost with hay. If the rangeland livestock forage had to be totally replaced with alfalfa hay, the cost would be approximately $1,517,328 for public land and $1,875,744 for private land, or a total of $3,393,072 (USDS-Cooperative Extension Service, Elko, Personal Communication). The above figures are based upon a $90 per ton price for alfalfa.

There are an estimated 57,000 acres of cropland within the 682,000 acres of economically infested grasshopper areas. These 57,000 acres of cropland are composed mostly of meadow hay, alfalfa hay, and less than 5000 acres of potatoes. The potential <u>gross</u> annual production value of these crops is about $27,105,000[2]. It is highly unlikely that grasshoppers would destroy a major portion of these crops; however, we do know that grasshoppers could potentially cause considerable damage.

This has been demonstrated by firsthand observation and systematic studies. Nerney and Hamilton (1969) reported

that in 1954 in Arizona, 99 percent of the vegetation was destroyed at a density of 50 to 77 grasshoppers per square meter. Nerney also found that total damage caused by 11 to 32 grasshoppers per square meter ranged from 8 to 63 percent. The extent of grasshopper damage depends on variables such as grasshopper density throughout the summer, type of vegetation, type of grasshopper, weather conditions, condition of the range, and other factors.

The total cost of pesticide treatment for the 682,000 acres of economically infested areas could conceivably cost $834,530 for public land and $515,829 for private land, or a total of $1,350,359 (APHIS, Dan Kail, Personal Communication). This is based on a $1.98 per acre price for malathion application.

It should be noted that one application of insecticide could eradicate or reduce grasshopper infestations for up to seven years, thus increasing by several times the benefits for the initial cost year. However, use of ULV malathion may not provide control beyond the year of application (Blickenstaff et al. 1974).

Summary (Worst-case analysis)

Land Value	
Value of Forage (using AUM fee value)....	$ 733,280
Potential Gross Annual Crop Value........	$27,105,600
Replacement Costs	
Cost of Total Replacement with Alfalfa Hay	$3,393,072
Cost of Reseeding Total Area............	$10,230,000[3]
Pesticide Treatment Cost (Malathion).........	$ 1,350,000

* * * * * * * * * * * * *

There is concern for the environmental damage that may result from the application of malathion over large areas. While a dollar value cannot be placed on the enjoyment of the natural environment, Nevadans have historically viewed their recreational resources as an important part of their lifestyle. There is concern that the highly prized hunting and fishing resources may be adversely affected by the proposed action.

A worst-case analysis would reveal substantial losses of fisheries, upland game birds, hunter and fisherman recreation days, and tax monies used to meet the high cost of restocking destroyed fish and wildlife. Losses in fishery and wildlife resources would indirectly impact wilderness values. Drastic impacts to ecological communities cannot be accurately evaluated with regard to economic impacts, so this has not been attempted in the economic analysis.

One potential environmental hazard of great concern is the effect of malathion on native bees that are essential for pollination of seed alfalfa crops. Approximately 14,000 acres of land in Humboldt and Pershing Counties are currently in alfalfa seed production. The estimated annual cash value of this seed crop is about $6,000,000. The value of the wild alkali bee population in this area is about $4,000,000 (University of Nevada, Reno, Extension Service).

Registered beekeepers are notified prior to spraying operations so that hives can be moved. However, native bee beds cannot be moved.

Another potential environmental hazard is the contamination of municipal watersheds within the spray area. Although no evidence can be found that the proposed action would directly affect humans or that there would be the potential for a buildup of insecticide in the food web, it is known that both malathion and carbaryl remain toxic in water for extended periods after application. Potential effects, if any, may be unknown at present, but this aspect must be given consideration.

5. Mitigating Measures

The following steps, if implemented, would reduce the overall environmental effects of the proposed action.

a. Federal or state sensitive plants will be avoided by not spraying malathion or carbaryl/Sevin 4 Oil within two miles of known locations, except in the case of the Federally-listed *Astragalus yoder-williamsii* and *Eriogonum argophyllum*, a plant of high priority for Federal listing, which are to be avoided by a five-mile radius area. Carbaryl bait may be applied in these areas. (See attached maps.)

b. Spraying will not occur in areas with less than eight grasshoppers per square yard.

*c. A certified BLM or USFS Pesticide Control Officer will be present during operations on public lands. Communication between the Pest Control Officer and the pilot(s) shall be maintained during spraying operations.

*d. Since all the areas will not be treated at the same time, postspray observations will be conducted following treatment. Short-term ecological effects can be evaluated and recommendations for procedural changes can be incorporated into later applications (BM 6762.34c).

BLM WORKFORM

Date checked: ____________ Initials: ______________

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   Series statement: ____

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   Subjects: ____

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   Other: ____

e. The dune systems of Paradise, Silver State, and Desert Valleys in Humboldt County will be excluded from any application of insecticides due to the unique habitat there and the high number of known endemic insects.

f. No aerial spraying will be conducted within municipal watersheds. (See attached maps.)

g. Malathion or Carbaryl/Sevin 4 Oil will not be used in municipal watersheds. Carbaryl 5% bait may be applied on selected sites, such as egg beds, or in strip application in front of migrating juvenile or adult Mormon crickets.

h. Application methods will be altered so as to ensure that no measurable amount of pesticide is applied directly to, or allowed to drift into, any sensitive area. (See attached maps.)

i. No pesticide will be applied within one-quarter mile of any known Swainson's hawk use areas (potential nest sites) or known nest sites. (See Appendix 8.)

*j. All label instructions will be followed. (See Appendix 2 & 10.)

k. Sensitive areas will be avoided.

B. No action

1. Nonliving Components

a. Air: Air quality could be slightly impacted if a large amount of vegetation were removed by grasshoppers, which would open up areas to blowing dust. On the other hand, if a great deal of vegetation were removed, this would reduce the amount of fuel, decreasing the fire hazard as well as the chances for smoke pollution.

b. Soil: Erosion of topsoil could increase if vegetative cover were removed.

c. Water: Increased erosion caused by removal of vegetation could result in an increase in sediment load in streams. Since water's ability to erode soil is increased with an increased sediment load, bank cutting could be accelerated, resulting in further degradation of fish and aquatic invertebrate habitat.

*Standard operating procedures required by law or manual.

2. Living Components

a. Vegetation

(1) Terrestrial

Consumption of vegetation by foraging insects would continue unchecked. This would result in removal of forage for livestock and possible damage to plants due to continuous feeding by grasshoppers beyond accepted percent use factors, along with destruction of seed heads, which would prevent reseeding (Hewitt 1977). On the other hand, Burkhardt (1959) indicates that chewing insects such as grasshoppers may effectively prune plants, resulting in plants with increased vigor and growth.

(2) Aquatic

No impacts to aquatic vegetation are anticipated.

b. Animals

(1) Mammals

Under the No Action alternative, large herbivores, including domestic livestock and big game, would be most directly impacted. At the economic infestation level of 8 grasshoppers per square yard, grasshoppers would consume or destroy up to 112 pounds of vegetation per acre. Infestations at this level and higher could result in complete utilization of forage allocated to grazing animals.

In addition, vegetative cover for all wildlife could be destroyed or significantly reduced. Seed-eating mammals could be adversely affected by the loss of seed producing plants, particularly grasses.

(2) Birds

An increase in grasshoppers would increase the food supply of some birds, while others would suffer a food loss as seedproducing plants decreased. Nesting and protective cover could be lost in heavily infested areas.

(3) Reptiles and Amphibians

Reptiles and amphibians could have an increased food supply.

(4) Invertebrates

(a) Terrestrial

Invertebrate predators and parasites of the pest species should increase with the pest species population until the latter peaks and declines due to natural causes. This is a slow process, requiring several years to control infestations. The decline in plants due to pest grazing may have an impact on the population of other insects relying on plants as a food source.

(b) Aquatic

Increased siltation in streams in areas of severe grasshopper depredations on watershed vegetation would cause a reduction in suitable habitat for aquatic invertebrates. It could also bring about a possible shift in species towards more sediment tolerant species.

(5) Fish

Damage to fish habitat from siltation and loss of riparian vegetation areas which provide shade and cover for the stream would occur in areas of extreme grasshopper depredations. This increased siltation would impact fish habitat by covering spawning gravels and reducing suitable areas for macroinvertebrates to live. It could also result in the partial filling of pools.

c. Endangered, Threatened, Rare, or Sensitive Species

(1) Vegetation

Sensitive plants may be consumed by the pest species. However, the intensity of this impact may be minimal considering seed longevity, perenniation of underground parts, and other factors.

(2) Mammals

No anticipated impacts would occur.

(3) Birds

No impacts would be anticipated.

(4) Invertebrates

Sensitive invertebrate species which depend on plants for food and other needs may be adversely impacted.

(5) Fish

The Lahontan cutthroat trout, red-banded trout, and Relict steptoe dace would be adversely impacted due to increased siltation and loss of riparian vegetation. (See previous discussion.)

3. Ecological Interrelationships

Plants, like animals, require food for growth and sustenance. Animals acquire food material by eating plants or other animals. Plants manufacture food substances (Hormay 1970).

In perennials, part of the food material manufactured by plants each year is stored for future use. Some of these reserves are used to initiate growth in spring and to nourish the plant when it is not manufacturing food, such as in the winter when the plant is dormant. Reserves are replenished regularly in normal growth (Hormay 1970).

Perennials store enough food to last for several years. Thus, even if a plant is defoliated by grazing or by foraging insects for a year or two, it normally does not die. However, under continuous grazing beyond accepted percent use factors year after year during the growth period, perennials cannot make and replenish reserves. Consequently, reserves are ultimately depleted and the plant dies (Hormay 1978). This analysis assumes that natural biological and climatic controls of grasshopper infestations do not occur.

4. Human Values

As described in the Human Values section of the proposed action, the potential for economic hardship on the ranching community could be realized should the No Action alternative be imposed. Recreational and environmental values could be either preserved or allowed to succumb to a naturally occurring cycle.

5. Mitigating Measures

No mitigating measures are proposed for this alternative.

C. Biological Control

1. Nonliving Components

a. Air: No impacts are anticipated.

b. Soil: No impacts are anticipated.

c. Water: No impacts are anticipated.

2. Living Components

a. Vegetation

(1) Terrestrial

The alternative would eliminate foraging insects by disease or predation. Consequently, vegetation which would have otherwise been consumed or damaged would be conserved. There would be some loss of vegetation by foraging insects before the biological controls took effect. Amounts of vegetation loss cannot be predicted. However, Nosema requires two to six weeks to effectively control grasshopper populations. Vegetation would continue to be consumed during this period.

(2) Aquatic

No impacts are anticipated.

b. Animals

(1) Mammals

Food shortages for insectivorous mammals could occur. However, impacts should be minimal overall.

(2) Birds

Only target insects would be affected by the biological control agent Nosema locustae. This could cause some decrease in the food supply of insectivorous animals, especially birds. However, the decline in grasshopper

populations would be gradual over several weeks. Since other insects would not be affected, it is expected that impacts would be minimal.

(3) Reptiles and Amphibians

A food shortage could possibly occur. However, overall impacts should be minimal.

(4) Invertebrates

Only grasshoppers and cricket species, including the Mormon cricket, would be affected by Nosema locustae. Other invertebrates would not be affected.

Agelenidae spiders would feed on the most abundant of its prey species, in this case the grasshopper or Mormon cricket pest. As these populations were reduced and competition for territory became more severe, the spiders would feed on other invertebtates and on each other. The result would be a reduced spider population following decreased prey abundance and a greater amount of territory required to support each spider.

(5) Aquatic Animals

No impacts are anticipated.

c. Threatened, Endangered, Rare, or Sensitive Species

Only endemic species of crickets and grasshoppers, if any, are expected to be impacted. However, any impacts would most likely be minimal since biological control methods would not provide a total kill of the host species.

3. Ecological Interrelationships

The principle of biological controls is to introduce or increase the numbers of naturally occurring organisms that are specific enemies of the target pest. In this way, the pest is brought into balance in the ecosystem with minimal adverse effects on other members of the community.

The inoculation of grasshoppers with the Nosema protozoan has been shown to be an effective method of control

(Henry et al. 1978). By applying Nosema impregnated bran flake bait, grasshopper populations have been decreased 38 to 44 percent within 4 to 7 weeks. In addition, the organism is viable in the population for future control (Onsager 1980, personal communication).

The funnel-web spider is a selective predator of grasshoppers. It has been found to regulate its feeding according to the density of its prey population and to have no effect on other organisms (Riechert 1980). It is also a highly territorial species and would regulate its own numbers through cannibalism as the abundance of prey declined. Maintenance of diversity of natural invertebrate predators and parasites would enhance natural control as pest populations increased.

Although a strict biological control program is not feasible this year, these methods are considered as part of the Integrated Pest Management Alternative.

4. Human Values

The impact of biological control on human values would primarily involve the added expense of this alternative. The cost of Nosema is about $3.00 per acre, as opposed to the $2.00 per acre cost of malathion. In addition, Nosema does not result in as effective a kill rate as malathion, (50 percent versus 85 percent).

5. Mitigating Measures

Because the biological controls discussed for this alternative are naturally occurring organisms, there are no measures that could be taken to reduce their impacts.

D. Cultural Control

1. Nonliving Components

a. Air: No impacts are anticipated.

b. Soil: Improvement in vegetative cover would result in less erosion, increased soil depth, and eventual improvement in soil properties, e.g., soil structure, organic matter, and water-holding capacity.

c. Water: Over a long period of time, water quality should improve as a result of better range condition and decreased sedimentation.

If removal of vegetative cover were severe, the

short-term impact of using only cultural control could be degraded water quality and increased sedimentation caused by grasshopper damage to vegetation cover.

2. Living Components

a. Vegetation

(1) Terrestrial

Vegetation would be consumed and damaged by the unchecked populations of foraging insects. Should climatic conditions be conducive to high populations over a number of years, permanent damage could result to plants because of continued feeding beyond accepted percent use factors and destruction of seed heads, which would prevent reseeding (Hewitt 1977). Over the long term, cultural control may result in a natural decrease in foraging insect numbers, which would, in turn, improve range condition.

(2) Aquatic

No impacts are anticipated.

b. Animals

(1) Terrestrial

Since cultural control is a slow-acting, long-term means of grasshopper control, environmental impacts under this alternative would essentially be the same as those under the No Action alternative over the next few years. Eventually, improved range condition and attendant increases in forage, cover, and habitat diversity would result.

(2) Aquatic

(a) Invertebrates

Aquatic invertebrate populations should generally benefit from the reduced siltation, which would provide a more balanced population structure and better habitat for the invertebrate species. Some shifts in population structure away from sediment tolerant species would be expected. The above-mentioned benefits would be observed only after a long period of time.

The short-term impact would be increased sedimentation, which would be to the detriment of aquatic invertebrates. There could also be possible shifts in population structure toward more sediment tolerant species due to increased siltation from grasshopper depredations in the watershed vegetation.

(b) Fish

Improvement in range condition would benefit fish through reduced siltation in streams and improved riparian areas, which would provide more shade and cover. The above-mentioned benefits would be observed only after a long period of time.

The short-term impact of using only cultural control would be increased siltation in the streams, which would degrade fish habitat. The loss of riparian vegetation in some areas would reduce stream shade and cover if grasshopper depredations became severe.

c. Threatened, Endangered, Rare or Sensitive Species

(1) Vegetation

No adverse impacts are anticipated.

(2) Animals

Fish could suffer a short-term, adverse impact from increased siltation due to grasshopper grazing damage before long-term benefits were realized.

No other adverse impacts are anticipated.

3. Ecological Interrelationships

As discussed in the introduction, cultural controls would not remedy the current situation. However, because range improvement practices would help prevent future outbreaks, an analysis of cultural methods is discussed under, and also considered as a component of, the IPM system (following section).

4. Human Values

The major concern of the cultural control alternative is

the ranching community's reduction in livestock use on public lands. Such reductions could be necessary to improve range conditions, which would deprive the grasshopper of its breeding grounds.

Campbell et al. (1974) found grasshoppers less abundant in areas where deferred grazing practices were being used as opposed to areas where pastures were being heavily grazed. This may indicate that deferred grazing practices could work as well as AUM reduction, but further study in this area is required.

5. Mitigating Measures

No mitigating measures are proposed for this alternative.

E. The Integrated Pest Management (IPM) Alternative

Under an IPM system, the use of chemical, biological, and cultural controls would be blended into a comprehensive program that would offer maximum long-term protection with the least adverse effect on the ecosystem. Areas of critical concern, such as streams, nesting areas, and bee beds, would be treated with selective biological controls. Nonsensitive areas could be treated with a nonselective chemical. The initial treatment would then be augmented by cultural practices to improve range condition, thereby eliminating conditions which favor grasshoppers and other pests.

For the 1981 migratory grasshopper program, this alternative would consist of combining the use of malathion ULV with parasitic protozoan *Nosema locustae* inoculated bait, followed by cultural practices such as improved grazing systems, brush management, and distribution of livestock through water development. Range improvement plans would be developed through the Bureau Planning System after completion of the environmental impact statements.

The impacts of the IPM alternative would be the same as those addressed under the proposed action and the biological control alternative, where applicable. If areas of high fishery, wildlife, sensitive plants, and water quality values were treated with biological instead of chemical methods, the adverse impacts to these resources would be significantly reduced. Insectivorous mammals, birds, reptiles, and amphibians would have buffered areas in which to feed (biologically controlled areas) outside the chemically treated areas. Fisheries and aquatic invertebrates would suffer only minimal impacts from unavoidable drift of aerial application of chemicals. The chances of total eradication of an endemic invertebrate species would be reduced. Generally speaking, major riparian areas, where the majority of wildlife species are found, would be treated biologically and would be unaffected by chemical treatment.

1. Ecological Interrelationships

The ecological interrelationships where malathion is used would be the same as discussed in the analysis of the proposed action. However, because sensitive areas would not be sprayed, adverse impacts would be greatly reduced. The food web would not be significantly altered because by avoiding water, riparian zones, and other sensitive areas, large contiguous blocks of land would not be involved.

The Nosema locustae inoculated bait is specific for grasshoppers. When the bran bait is consumed, the Nosema spores germinate and multiply in the grasshoppers stomach, eventually causing death. The grasshoppers, being cannibalistic, inoculate each other, spreading the disease throughout the population. The Nosema infection continues to reduce the population and remains in the survivors for future control (Onsager 1980). The control has an expected effective life of three to five years (Onsager 1980, personal communication).

2. Human Values

Added expense would be incurred in areas being controlled with a biological agent. (See Appendix 7.)

3. Mitigating Measures

When enough Nosema and funnel spiders were produced to treat large areas, the chemical component of this alternative could be discontinued, thus eliminating the possibility of accidental chemical contamination of sensitive areas.

Malathion would be used in this alternative with the same mitigating and control measures described for the proposed action.

Footnotes to Chapter IV

[1] The AUM fee value for the Bureau of Land Management is currently \$2.36; for USFS, \$2.50. These fee values do not include several services provided by private land. A more realistic value per AUM is \$7.88 (Livestock Conservation Survey; Economics, Statistics and Cooperative Service, USDA).

[2] This amount is based on a rough estimate of crop acreage using Soil Conservation Service Maps and County Extension Agents estimates. It is also a gross figure without operating costs; that is, it is not a profit figure. It also proposes full production of these crops at current market prices. In actuality, only 10 percent of the hay crop is sold, the remainder retained for livestocks.

[3] This amount is arrived at using \$15.00 per acre reseeding costs (Bob Bolton, BLM, Personal Communications). This amount does not include the 2-year loss of grazing capacity required after reseedings.

V. Unavoidable Adverse Impacts

Unavoidable adverse impacts would depend on the grasshopper control alternative selected. These impacts would be essentially the same as those outlined for all alternatives except the proposed action in the Environmental Consequences Section.

A. Proposed Action

Should the proposed action be implemented with the mitigating measures, the following impacts could occur:

1. Fisheries in streams of highest fishery value should not be impacted. However, streams of high-priority, substantial and limited fishery value (as delineated by the Nevada Department of Wildlife) could be impacted by a concentration of pesticides in surface waters in excess of the state and federal E.P.A. limit of 0.1 microgram/liter (0.1 ppb). Should this occur, a reduction of food supplies for fish would result because of the high toxicity of pesticides to aquatic invertebrates. Sublethal effects, secondary poisoning, and direct mortality of fish could also occur.

2. Residual effects of pesticide in water for weeks or even months following application could occur.

3. A shortage of food for insectivorous mammals and birds could result, leading to impairment of gallincaceous chick development.

4. An outward migration of birds from spray areas could result in nest abandonment.

5. Sublethal effects on small mammals and birds could make them more susceptible to predation.

6. Massive losses of nontarget arthropods, including pollinating bees and predatory spiders that inhabit the same area as the target species, could occur.

B. Other Alternatives

Because there are no mitigating measures applicable to the other alternatives (except IPM), the unavoidable adverse impacts would be the same as those discussed under Environmental Consequences. The unavoidable adverse impacts discussed for the proposed action would also apply to areas of chemical application for the IPM alternative.

VI. Short-Term Use versus Long-Term Productivity

The use of malathion would have a short-term effect on the food web. Invertebrate populations would be decreased, which would affect animals that depend on them as a food source. The vegetation in the treated areas which would otherwise be consumed by grasshoppers would be available for livestock and wildlife.

The long-term productivity cannot be predicted on the basis of a one-year treatment program. While the vegetative resource would be protected for this season, future protection would depend on the ability of the grasshopper population to recover from the treatment and the rate of their migration from untreated areas.

VII. Irreversible and Irretrievable Commitment of Resources

No irreversible and irretrievable commitments of resources are foreseen.

VIII. Persons, Groups and Government Agencies Consulted

Ballow, T., Executive Director, Nevada State Department of Agriculture, Reno, Nevada.

Bottari, P., Executive Secretary, Nevada Cattlemen's Association, Elko, Nevada.

Campbell, W., Fish and Game Agent II, Nevada Department of Wildlife, Austin, Nevada.

Campsey, L., District Conservationist, USDA, Soil Conservation Service, Elko, Nevada.

Champney, W.O., Assistant Agricultural Economist, Division of Agricultural and Resource Economics, Max C. Fleishmann College of Agriculture, University of Nevada-Reno, Reno, Nevada.

Davis, G., Fisheries Program Coordinator, Utah Division of Wildlife Resources, Salt Lake City, Utah.

Eckert, D., Range Scientist, USDA, SEA/AR, Renewable Resource Center, University of Nevada-Reno, Reno, Nevada.

Foster, R.N. III, Entomologist, USDA, APHIS, PPQ, Methods Development Pink Bollworm Field Laboratory, Phoenix, Arizona.

Hackett, I., County Agent, USDA, Cooperative Extension Service, Elko, Nevada.

Jackson, D.S., District Director, USDA, APHIS, PPQ, Seattle, Washington.

Johansen, C.A., Entomologist, Department of Entomology, Washington State University, Pullman, Washington.

Jones, I., Fish and Wildlife Biologist, Environmental Management Section, Oregon Department of Fish and Wildlife, Portland, Oregon.

Kail, J.D., Officer in Charge, USDA, APHIS, PPQ, Elko, Nevada.

Lawrence, G., Area Seed Specialist, USDA, Cooperative Extension Service, Winnemucca, Nevada.

Leppink, J., Regional Fishery Biologist, Utah Division of Wildlife Resources, Cedar City, Utah.

Linsley, E. G., Entomologist, Department of Entomology, University of California, Berkeley, California.

Marteney, W.J., 1st Vice President, Nevada Cattlemen's Association, Elko, Nevada.

Martinelli, P., Director, Division of Plant Industry, Nevada State Department of Agriculture, Reno, Nevada.

Myer, G.L., Division of Agricultural and Resource Economics, Max C. Fleishmann College of Agriculture, Reno, Nevada.

Nevada Department of Wildlife, Elko, Nevada.

Nevada Department of Wildlife, Reno, Nevada.

Onsager, J.A., Research Entomologist, USDA, Rangeland Insect Laboratory, Montana State University, Bozeman, Montana.

Parker, F.D., USDA, Bee Biology Laboratory, Utah State University, Logan, Utah.

Platts, W.S., Research Fishery Biologist, Intermountain Forest and Range Experiment Station, USFS, Boise, Idaho.

Reichert, S.E., Arachnologist, Department of Zoology, University of Tennessee, Knoxville, Tennessee.

Rowe, D., Regional Coordinator, Division of Plant Industry, Nevada State Department of Agriculture, Reno, Nevada.

Shea, P.J. Supervisory Entomologist and Project Leader, USFS, Pacific Southwest Forest and Range Experiment Station, Davis, California.

Sleek, T., Manager, Government Affairs, Sandoz, Inc., Crop Protection, San Diego, California.

Smith, H., Pesticide Specialist, Department of Biochemistry and Pesticides, Max C. Fleishmann College of Agriculture, University of Nevada-Reno, Reno, Nevada.

Teske, L., Fish and Game Agent II, Nevada Department of Wildlife, Battle Mountain, Nevada.

Thorpe, R.W., Entomologist, Department of Entomology, University of California, Davis, California.

United States Department of Agriculture, Bee Laboratory, Utah State University, Logan, Utah.

United States Department of Agriculture, Plant Protection and Quarantine, Plant and Animal Health Inspection Service, Elko, Nevada.

United States Department of Agriculture, Rangeland Insect Laboratory, Bozeman, Montana.

United States Department of the Interior, Fish and Wildlife Service, Reno, Nevada.

United States Department of the Interior, Fish and Wildlife Service, Fish Pesticide Research Laboratory, Columbia, Missouri.

United States Environmental Protection Agency, Washington, D.C.

United States Environmental Protection Agency, Environmental Research Laboratory, Athens, Georgia.

Weller, G., Fish and Game Agent II, Nevada Department of Wildlife, Winnemucca, Nevada.

XI. Intensity of Public Interest

Public scoping meetings were held in Reno, Elko, Winnemucca, Battle Mountain, Owyhee, and Austin. Through these meetings, issues and concerns were identified and attempts were made to incorporate these into the EA where applicable.

This section will be updated following review of this draft document.

A. Environmental Assessment Team

1. Direct Contributors

Roy Masinton, BLM, Elko: Fishery biologist, Team Leader; overall responsibility for EA.

Frank Maxwell, BLM, Reno: Environmental coordinator; responsible for EA format and State Office guidence.

Monte McClendon, BLM, Elko: Environmental Protection Specialist, responsible for EA procedures, review and coordination.

Ted Angle, BLM, Winnemucca: Soil/Water/Air specialist; responsible for watershed and general vegetative analysis.

John Bullock, BLM, Elko: Range conservationist; responsible for soil, water, air, and general range analysis.

Bill Slaichert, BLM, Elko: Economist; responsible for economic analysis.

Dwayne Sykes,BLM, Battle Mountain: Wildlife management biologist; responsible for terrestrial wildlife analysis.

Steve Wernsing, USFS, Elko: Aquatic habitat biologist; responsible for aquatic wildlife (including aquatic invertebrates) analysis.

Mike Yoder-Williams, BLM, Winnemucca: Botanist; responsible for vegetative and general terrestrial invertebrate analysis.

2. Indirect Contributors

Pat Coffin, Nevada Department of Wildlife, Elko: Regional fishery assistant; provided technical assistance for fisheries.

Willie Molini, Nevada Department of Wildlife, Reno: Chief of habitat section; provided Nevada Department of Wildlife recommendations.

Walt Hanks, USFS, Elko: Range, wildlife, watershed, minerals staff officer; provided USFS technical and format guidance.

Bill Pyott, BIA, Owhyee: Range Conservationist; provided BIA recommendations.

B. Consulted Staff

Ballantyne, K., Wildlife Biologist, BLM, Elko, Nevada.

Bolton, B., Range Conservationist, BLM, Elko, Nevada.

Brazell, L., Watershed Specialist, BLM, Nevada State Office, Reno, Nevada.

Casey, O., Fisheries Biologist, BLM, Nevada State Office, Reno, Nevada.

Crispin, V., Fishery Biologist, BLM, Elko, Nevada.

Curtis, D.J., Program/Pesticide Manager, USFS, Regional Office, Ogden, Utah.

Dingman, J., Elko Resource Area Manager, BLM, Elko, Nevada.

Drais, G., Outdoor Recreation Planner, BLM, Elko, Nevada.

Duff, D., Aquatic Planner, USFS, Regional Office, Ogden, Utah.

Foster, K.E., Hydrologist, USFS, Humboldt National Forest, Elko, Nevada.

Haburchak, R., Chief, Planning and Environmental Coordinator, BLM, Elko, Nevada.

Kenny, B., Soil Scientist, BLM, Elko, Nevada.

Kimpton, D., District Forest Ranger, USFS, Mountain City Ranger District, Humboldt National Forest, Elko, Nevada.

Mangum, F.A., Fishery Biologist, USFS, Aquatic Ecosystems Analysis Lab, Brigham Young University, Provo, Utah.

McClendon, M., Environmental Protection Specialist, BLM, Elko, Nevada.

Meyers, P., Regional Economist, BLM, Nevada State Office, Reno, Nevada.

Nix, G.E., Range Technician, USFS, Austin Ranger District, Toiyabe National Forest, Austin, Nevada.

Oke, C., Range Conservationist, BLM, Winnemucca, Nevada.

Siebert, D., Hydrologist, BLM, Elko, Nevada.

Stark, R., Supervisory Range Conservationist, BLM, Elko, Nevada.

Stickley, G., Chief of Resources, BLM, Winnemucca, Nevada.

Tol, D., Fishery Biologist, BLM, Winnemucca, Nevada.

Wangsgard, L., Wells Resource Area Manager, BLM, Elko, Nevada.

Woerner, R., Writer/Editor, BLM, Elko, Nevada.

Yoder-Williams, M. J., Biological Technician, BLM, Winnemucca, Nevada.

C. Signatures

1. EA Team Members

Roy Masinton; Team Leader	Date
Frank Maxwell; Environmental Coordinator, NSO	Date
Monte McClendon; Environmental Protection Specialist	Date
Ted Angle; Soil, Water & Air Specialists	Date
John Bullock; Range Conservationist	Date
Bill Slaichert; Economist	Date
Dwayne Sykes; Wildlife Management Biologist	Date
Steve Wernsing; Aquatic Habitat Biologist	Date
Mike Yoder-Williams; Botanist	Date

2. Supervisory Personnel

Superintendant of Eastern Nevada Agency, Bureau of Indian Affairs	Date
Elko District Manager Bureau of Land Management	Date
Winnemuca District Manager Bureau of Land Management	Date
Battle Mountain District Manager Bureau of Land Management	Date
Forest Supervisor, Humboldt National Forest	Date
Forest Supervisor, Toiyabe National Forest	Date

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APPENDIX 1

HISTORY OF MALATHION USE IN NORTHERN NEVADA

APPENDIX 1

HISTORY OF MALATHION USE IN NORTHERN NEVADA

USDA, APHIS, PPQ

GRASSHOPPER CONTROL PROGRAMS

NEVADA

MALATHION @ 8OZ./ACRE

YEAR	COUNTY	ACREAGE
1971	Humboldt	11,984
1972	Elko	10,368
1972	Eureka	35,762
1972	Humboldt	6,272
1973	Elko	19,264
1974	Pershing	28,960
1974	Washoe	832
1975	Elko/Eureka	21,984
1976	Elko	11,232
1979	Humboldt	40,704

APPENDIX 2

PESTICIDE LABELS

APPENDIX 2

PESTICIDE LABELS

CYTHION®

INSECTICIDE

'THE PREMIUM GRADE MALATHION'®

Active Ingredient: Malathion**	91.0%
Inert Ingredients	9.0%
Total	100.0%

**O,O-dimethyl phosphorodithioate of diethyl mercaptosuccinate

EPA Reg. No. 241-208 (One gallon contains 9.33 pounds of malathion) EPA Est. No. 241-NJ-2

CYANAMID

PRECAUCÍON

AL USUARIO: Si usted no lee inglés, no use este producto hasta que la etiqueta le haya sido explicada ampliamente. (TO THE USER: If you cannot read English, do not use this product until the label has been fully explained to you.)

In case of an emergency endangering life or property involving this product, call collect, day or night, Area Code 201 835 3100

REFER TO ATTACHED LEAFLET ON TOP OF PAIL FOR DIRECTIONS FOR USE

KEEP OUT OF REACH OF CHILDREN

CAUTION

*Trademark of American Cyanamid Company

U.S. GALS. — 5	18.9 liters	
AV. GROSS — 55.25	25.23 kg	94600-05 D50
NET WT. — 51.25	23.06 kg	

ACCEPTED

JUN 3 1980

Under the Federal Insecticide, Fungicide, and Rodenticide Act, as amended, for the pesticide registered under EPA Reg. No. 241-208

CYTHION

'The Premium Grade Malathion'

Before using CYTHION insecticide for the preparation of malathion insecticides, manufacturers should consult American Cyanamid Company for manufacturing and handling instructions.

PRECAUTIONARY STATEMENTS

HAZARDS TO HUMANS (AND DOMESTIC ANIMALS)

CAUTION

HARMFUL BY SWALLOWING, INHALATION OR SKIN CONTACT

Avoid breathing spray mist • Avoid contact with skin • Wash thoroughly after handling • Change contaminated clothing • Do not contaminate food or feed products

ENVIRONMENTAL HAZARDS

This product is toxic to fish. Avoid direct applications to lakes, streams, ponds, tidal marshes and estuaries. Do not apply where runoff is likely to occur. Do not apply when weather conditions favor drift from areas treated. Do not contaminate water by cleaning of equipment or disposal of wastes. Shrimp and crab may be killed at application rates recommended on this label. Do not apply where these are important resources. Apply this product only as specified on this label.

BENEFICIAL INSECT CAUTION

This pesticide is highly toxic to bees exposed to direct treatment or to residues remaining on the treated area. Do not apply this product or allow drift when bees are actively visiting the treatment area. Applications should be timed to provide the maximum possible interval between treatment and the next period of bee activity. Further protective information may be obtained from your Cooperative Agricultural Extension Service.

DIRECTIONS FOR USE

It is a violation of Federal law to use this product in a manner inconsistent with its labeling.

CYTHION may only be used in accordance with the directions in the attached CYTHION leaflet or approved supplementary labeling. Read all directions carefully before using.

STORAGE AND DISPOSAL

Do not contaminate water, food or feed by storage or disposal. *Pesticide Disposal:* Open dumping is prohibited. Pesticide spray mixture or rinsate that cannot be used or chemically reprocessed should be disposed in a landfill approved for pesticides or buried in a safe place away from water supplies. *Container Disposal:* Triple rinse: (1) Drain container into spray tank (after normal emptying) in a vertical position for 30 seconds. (2) Rinse carefully 3 times with 1 gallon of water for each rinse and drain spray tank after each rinse. (3) Do not re-use container. Dispose of container in an approved landfill or bury in a safe place. Consult Federal, state or local disposal authorities for approved alternatives.

DISCLAIMER

The label instructions for the use of this product reflect the opinion of experts based on field use and tests. The directions are believed to be reliable and should be followed carefully. However, it is impossible to eliminate all risks inherently associated with the use of this product. Crop injury, automotive paint damage, ineffectiveness or other unintended consequences may result because of such factors as weather conditions, presence of other materials, or the use or application of the product contrary to label instructions, all of which are beyond the control of American Cyanamid Company. All such risks shall be assumed by the user.

American Cyanamid Company warrants only that the material contained herein conforms to the chemical description on the label and is reasonably fit for the use therein described when used in accordance with the directions for use, subject to the risks referred to above.

Any damages arising from a breach of this warranty shall be limited to direct damages and shall not include consequential commercial damages such as loss of profits or values or any other special or indirect damages.

American Cyanamid Company makes no other express or implied warranty, including any other express or implied warranty of FITNESS or of MERCHANTABILITY.

The sale of this product does not include a license under any patent owned by the American Cyanamid Company.

AMERICAN CYANAMID COMPANY
AGRICULTURAL DIVISION
WAYNE, NEW JERSEY 07470

RECEIVED
BUR. OF LAND MANAGEMENT
NOV 10 1980
ELKO DISTRICT OFFICE
[illegible]D, NEVADA

77% of ORIGINAL SIZE

ACCEPTED
MAR 20 1980
Under the Federal Insecticide, Fungicide, and Rodenticide Act, as amended, for the pesticide registered under EPA Reg. No. 264-320

UNION CARBIDE

SEVIN®
CARBARYL INSECTICIDE

Net Wt. ____________ lbs.

5% BAIT

FOR CONTROL OF INSECT PESTS

Active Ingredients: Carbaryl (1-naphthyl methylcarbamate) .... 5% by wt.
Inert Ingredients .... 95% by wt.

E.P.A. Reg. No. 264-320 E.P.A. Est. No. ____________

KEEP OUT OF REACH OF CHILDREN
CAUTION

PRECAUTIONARY STATEMENTS

HAZARDS TO HUMANS AND DOMESTIC ANIMALS:
HARMFUL IF INHALED OR SWALLOWED. Avoid Breathing of Dust. Do Not Take Internally. Avoid Contact with Skin and Eyes.

Wear regular long-sleeved work clothing. Change to clean clothing daily. Wash hands and face before eating. Wash thoroughly after handling.

NOTE FOR PHYSICIAN: Carbaryl is a moderate, reversible cholinesterase inhibitor. Atropine is antidotal.
Do Not Use 2-PAM, opiates, or cholinesterase inhibiting drugs.

ENVIRONMENTAL HAZARDS:

→ Avoid direct application to lakes, streams and ponds. Do not apply when weather conditions favor drift from area treated. Do not contaminate water by cleaning equipment or disposal of wastes.

IN CASE OF EMERGENCY, TELEPHONE COLLECT (24 HOURS A DAY) IN THE U.S.A. (304) 744-3487

WARRANTY

1. The manufacturer warrants (a) that this product conforms to the chemical description on the label; (b) that this product is reasonably fit for the purposes set forth in the directions for use when it is used in accordance with such directions, and (c) that the directions, warnings and other statements on this label are based upon responsible experts' evaluation of reasonable tests of effectiveness, of toxicity to laboratory animals and to plants, and of residues on food crops, and upon reports of field experience. Tests have not been made on all varieties or in all states or under all conditions. THE MANUFACTURER NEITHER MAKES NOR INTENDS, NOR DOES IT AUTHORIZE ANY AGENT OR REPRESENTATIVE TO MAKE, ANY OTHER WARRANTIES, EXPRESS OR IMPLIED, AND IT EXPRESSLY EXCLUDES AND DISCLAIMS ALL IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE.
2. This warranty does not extend to, and the Buyer shall be solely responsible for, any and all loss or damage which results from the use of this product in any manner which is inconsistent with the label directions, warnings or cautions.
3. BUYER'S EXCLUSIVE REMEDY AND MANUFACTURER'S OR SELLER'S EXCLUSIVE LIABILITY FOR ANY AND ALL CLAIMS, LOSSES, DAMAGES, OR INJURIES RESULTING FROM THE USE OR HANDLING OF THIS PRODUCT, WHETHER OR NOT BASED IN CONTRACT, NEGLIGENCE, STRICT LIABILITY IN TORT OR OTHERWISE, SHALL BE LIMITED, AT THE MANUFACTURER'S OPTION, TO REPLACEMENT OF, OR THE REPAYMENT OF THE PURCHASE PRICE FOR, THE QUANTITY OF PRODUCT WITH RESPECT TO WHICH DAMAGES ARE CLAIMED. IN NO EVENT SHALL MANUFACTURER OR SELLER BE LIABLE FOR SPECIAL, INDIRECT OR CONSEQUENTIAL DAMAGES RESULTING FROM THE USE OR HANDLING OF THIS PRODUCT.

UNION CARBIDE AGRICULTURAL PRODUCTS COMPANY, INC.
7825 BAYMEADOWS WAY, JACKSONVILLE, FLORIDA 32216

UCC-2700710
Made in U.S.A.

DIRECTIONS FOR USE

It is a violation of Federal law to use this product in a manner inconsistent with its labeling.

Read Entire Label. Use Strictly According To Label Directions and Cautions. Do not use application methods, dosages, concentrations, or frequencies not listed on labeling. Do not apply against target pests not listed on labeling. Do not mix with fertilizers.

Broadcast applications may be made with either ground equipment or aircraft. Treatments may be repeated as necessary. Dosages from 20–40 pounds per acre of Bait will control cutworms, armyworms, crickets, darkling ground beetles, grasshoppers and sowbugs.

Crop	Dosage/Acre	Days Between Final Application and Harvest
Cucumbers, squash, melons, peanuts.	20 pounds	None
Alfalfa, peas	30 pounds	None
Cotton	30 pounds	None
Beans, carrots, corn, eggplants, okra, peppers, potatoes, tomatoes, and sweet corn	20-40 pounds	None
Asparagus, strawberries	20-40 pounds	1 Day
Broccoli, brussels sprouts, cabbage, cauliflower, head lettuce, garden beets (roots), horseradish, parsnips, radishes, rutabagas, and turnips (roots)	20-40 pounds	3 Days
Sugar beets, collards, endive (escarole); garden beets (tops, kale, leaf lettuce, parsley, spinach, Swiss chard and turnips (tops)	20-40 pounds	14 Days

IMPORTANT PRE-HARVEST AND GRAZING USE INFORMATION

Tolerances established under the Federal Food, Drug and Cosmetic Act permit the sale of crops bearing probable SEVIN residues when SEVIN is used in accordance with label directions.

If SEVIN insecticide is used in accordance with label directions, these crops including bean vines, carrot tops, pea vines, sugar beet tops, corn forage and cotton forage may be grazed or harvested for use as feed for dairy and meat animals without resulting in illegal residues in milk or meat.

STORAGE AND DISPOSAL

Do not contaminate water, food or feed by storage or disposal. Open dumping is prohibited.

Unused pesticide, should be disposed of in a landfill approved for pesticides or buried in a safe place away from water supplies.

Do not reuse empty containers. Dispose of in an incinerator or landfill approved for pesticide containers, or bury in a safe place.

Consult Federal, State or Local disposal authorities for approved alternative procedures such as limited open burning.

glue

glue

ACCEPTED

MAY 9 1980

Under the Federal Insecticide, Fungicide, and Rodenticide Act, as amended, for the pesticide registered under EPA Reg. No. 11273-27

NOLOC™

CONCENTRATE

A BIOLOGICAL INSECTICIDE FOR FORMULATING USE ONLY

	% By Weight
ACTIVE INGREDIENTS:	
2 x 10^9 Nosema locustae spores per ml.	15
INERT INGREDIENTS:	
Distilled water	85
	100

KEEP OUT OF REACH OF CHILDREN

CAUTION

PRECAUTIONARY STATEMENTS

HAZARDS TO HUMANS: Avoid inhalation or contact with eyes or open wounds.

See back panel for storage and disposal requirements and additional information.

MANUFACTURED BY

SANDOZ, INC., Crop Protection
480 Camino del Rio So., San Diego, California 92108

Net Contents: 250 ml
Lot No.________

SANDOZ

EPA Reg. No. 11273-27
EPA Est. No. 36299-CA-1

STORAGE AND DISPOSAL

PROHIBITION: Do not contaminate water, food or feed by storage or disposal. Open dumping is prohibited. Do not reuse empty container.

STORAGE: Store frozen at from 5°F to 25°F in original sealed container until use. Do not refreeze partial container.

Manufacturer to furnish formulator with complete directions for preparation and use.

NOTICE: Sandoz, Inc. makes no warranty, express or implied, including the warranties of merchantability and/or fitness for any particular purpose concerning this material except those which are contained on this label.

RECEIVED
APR 29 1980

Delivered
Federal Express

73

APPENDIX 3

AIRCRAFT CATEGORIES AND SWATH SPACING

Appendix 3

AIRCRAFT CATEGORIES AND SWATH SPACING

Aircraft are divided into categories. Shown below is the swath spacing each will be allowed. For aircraft other than those listed, the Government Representative shall establish the category and swath spacing for each type.

Category A

Aircraft	Undiluted & Oil Mixtures (Feet)	All Sevin 4-Oil, Diluted or Undiluted & Water Mixture (Feet)
Boeing B-17	500	350
Consolidated PB4-y	500	350
Douglas DC-4/DC-6/DC-7	550	400
Fairchild c-119	500	350
Lockheed Constellation	650	500
Category B		
Curtiss C-46	500	350
Douglas C-47 or DC-3	400	300
Lockheed Lodestar PV-2	400	300
Martin 404	500	350
Category C		
Bell 212 or 205A-Evergreen Spray Systems	150	100
Grumman TBM	250	150
Sikorsky S-55	150	100
Turbine Thrush	150	100
Twin Beech D-18	150	100
Category D		
Cessna AgCarryall & AgPickup	100	75
Cessna AgTruck & Agwagons	100	75
Commander Thrush & New Air Tractor (Snow)	125	100
Commander Quail	150	75
Grumman AgCats (Long Wing)	125	100
Grumman AgCats (400-600 hp)	100	75
Grumman AgCats (200-300 hp)	100	75
Murray MA-1	125	100
Piper Brave	100	75
Piper Pawnee (230-260 hp)	100	75
Stearman (450-600 hp)	100	75
Weatherly	100	75

APPENDIX 4

NATURAL ENEMY COMPLEX

OF GRASSHOPPERS

APPENDIX 4

NATURAL ENEMY COMPLEX OF GRASSHOPPERS

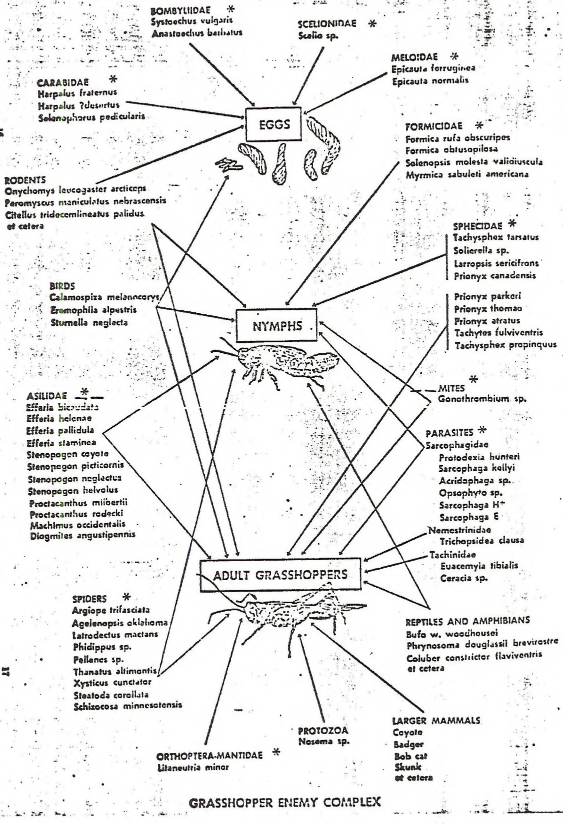

Figure A1-1. Natural predators/parasites of grasshoppers. Those groups marked by an asterisk would be impacted by ULV Malathion aerial spraying (adapted from Lavigne and Pfadt 1966). Generally, these species would also be impacted by the application of carbaryl.

APPENDIX 5

MAJOR FLORAL VISITORS AND THEIR ASSOCIATED NEVADA PLANT GENERA

TABLE A5-1

A CURSORY LIST OF THE MAJOR FLORAL VISITORS AND THEIR ASSOCIATED NEVADA PLANT GENERA[1]

Order: HYMENOPTERA Superfamily: APOIDEA (Bees)	
	Delphinium, Gilia, Ipomopsis, Mimulus, Microsteris, Salvia, Eriastrum (Grant and Grant 1965); Phacelia (Grant and Grant 1965; Atwood 1975); Acer, Symphoricarpos (Robertson 1929); Agastache, Asclepias, Cirsium, Mentzelia, Ranunculus (Gut et al. 1977; Grant and Grand 1965).
Family: Apidae Subfamily: Apinae (honeybees)	Penstemon (Schmid 1976; Grant and Grant 1965; Gut et al. 1977). Penstemon (Schmid 1976); Clarkia (MacSwain et al. 1973); Ascelpias (Wyatt 1976; Gut et al. 1977; Lynch 1977); Mentzelia (Gut et al. 1977); Hydrophyllum, Sambucus (Robertson 1929); Viola (Davidse 1976); Astragalus (Green and Bohart 1975).
Subfamily: Bombinae (bumblebees)	Asclepias (Wyatt 1976; Macior 1965; Lynch 1977; Gut et al. 1977); Astragalus, Balsamoriza, Lomatium (Green and Bohart 1975); Frasera (Beattie et al. 1973); Penstemon (Schmid 1976); Clarkia (MacSwain et al. 1973); Cirsium, Agastache (Gut et al. 1977); Phacelia, Delphinium, Polemonium, Monardella, Eriastrum (Grant and Grant 1965); Hydrophyllum, Silene, Achillea (Robertson 1929).
Family: Anthophoridae	Astragalus (Green and Bohart 1975); Camissonia (Raven 1969; MacSwain et al. 1973; Linsley et al. 1963).
Subfamily: Anthophorinae (digger bees)	Viola (Davidse 1976); Astragalus, Purshia (Green and Bohart 1975); Apocynum (Robertson 1929); Eriastrum, Gilia, Silene (Grant and Grant 1965); Ranunculus, Cirsium, Asclepias, Agastache (Gut et al. 1977); Oenothera (Linsley et al. 1963).
Subfamily: Xlocopinae (carpenter bees)	Penstemon (Schmid 1976; Gut et al. 1977); Clarkia (MacSwain et al. 1973); Asclepias (Gut et al. 1977; Lynch 1977); Hydrophyllum Sambucus (Robertson 1929); Aguilegia, Cirsium (Gut et al. 1977).
Subfamily: Nomadinae (cuckoo bees)	Lomatium (Schlessman 1978).

1 Actual documentation of pollination varies with the individual study cited.

Family: Halictidae	*Lomatium* (Schlessman 1978); *Gilia* (Grant and Grant 1965).
Subfamily: Nomiinae (alkali bees)	Alfalfa (Johansen 1980).
Subfamily: Dufoureinae	*Ranunculus* (Linsley and MacSwain 1959); *Frasera* (Beattie et al. 1973).
Subfamily: Halictinae (sweat bees)	*Penstemon*, *Cirsium*, *Agastache*, *Asclepias*, *Mentzelia*, *(Scrophularia* (Gut et al. 1977); *Achillea*, *Apocynum*, *Silene*, *Sambucus*, *Antennaria* (Robertson 1929); *Oenothera* (Linsley et al. 1963); *Nicotiana* (Wells 1959); *Ranunculus* (Gut et al. 1977; Linsley and MacSwain 1959); *Frasera* (Beattie et al. 1973); *Sisyrinchium* (Linsley and MacSwain 1959); *Camissonia* (MacSwain et al. 1973; Linsley et al. 1963); *Clarkia* (MacSwain et al. 1973); *Gilia*, *Eriastrum* (Grant and Grant 1965).
Family: Colletidae	
Subfamily: Hylaeinae (yellow faced bees)	*Asclepias*, *Scrophularia*, *Penstemon* (Gut et al. 1977).
Subfamily: Colletinae (plasterer bees)	*Frasera* (Beattie et al. 1973).
Family: Andrenidae	Sambucus (Robertson 1929).
Subfamily: Andreniae (andrenid bees)	*Ranunculus* (Linsley 1959; Gut et al. 1977); *Potentilla*, *Clarkia* (MacSwain et al. 1973); *Oenothera* (Linsley 1963; Linsley 1962); *Frasera* (Beattie et al. 1973); *Malacothrix* (Thorp 1969); *Camissonia* (Thorp 1969; Linsley et al. 1963).
Subfamily: Panurginae	*Ranunculus* (Linsley 1959); *Frasera* (Beattie et al. 1973).
Family: Megachilidae (leafcutting bees)	*Psoralea* (Parkes 1980); *Cirsium*, *Asclepias*, *Monardella*, *Agastache*, *Penstemon* (Gut et al. 1977); *Oenothera*, *Epilobium* (Linsley et al. 1963); *Astragalus* (Green 1975); *Frasera* (Beattie et al. 1973); *Lomatium* (Schlessman 1978), *Hydrophyllum*, *Antennaria*, *Achillea* (Robertson 1929) *Clarkia* (MacSwain et al. 1973).

Order: HYMENOPTERA (excluding the bees)

Family: Sphecidae (solitary wasps)	Frasera (Beattie et al. 1973).
Family: Vespidae (paper wasps, potter wasps, etc).	
Subfamily: Masarinae	Penstemon (Schmid 1976); Frasera (Beattie et al. 1973).
Subfamily: Eumeninae	Eriogonum (Knudson 1979); Frasera (Beattie et al. 1973).
Subfamily: Vespinae	Lomatium (Schlessman 1978); Frasera (Beattie et al. 1973).
Family: Ichneumonidae (ichneumons)	Frasera (Beattie et al. 1973).
Family: Formicidae (ants)	Frasera (Beattie et al. 1973).
Family: Tenthredinidae (common sawflies)	Frasera (Beattie et al. 1973).
Family: Argidae (argid sawflies)	Frasera (Beattie et al. 1973).

Order: COLEOPTERA (Beetles)

Ranunculus, Cirsium, Agastache, Monardella, Asclepias (Gut et al. 1977); Cleome (Barr and Foster 1979); Phacelia (Atwood 1975); Penstemon (Schmid 1976); Symphoricarpos (Robertson 1929); Frasera (Beattie et al. 1973); Eriogonum (Knudson 1979); Astragalus (Green 1975); Chrysothamnus (Linsley 1980); Gilia, Ipomopsis, Langloisia (Grant 1965); Sambucus (Robertson 1929).

Order: DIPTERA (flies)

Penstemon (Schmid 1976); Acer, Symphoricarpos, Hydrophyllum (Robertson 1929); Asclepias, Cirsium, Ipomopsis, Mentzelia, Ranunculus, Scrophularia (Gut et al. 1977); Frasera Beattie et al. 1973).

Family: Bombyliidae (beeflies)	Lomatium (Schlessman 1978); Viola (Davidse 1976); Collomia, Ipomopsis, Eriastrum, Langloisia, Linanthus (Grant and Grant 1965); Lithospermum, Sambucus (Robertson 1929); Frasera (Beattie et al. 1973); Penstemon (Schmid 1976).
Family: Syrphidae (syrphid or flower flies)	Viola (Davidse 1976); Sambucus (Robertson 1929); Nicotiana (Wells 1959); Astragalus (Green 1975); Penstemon (Schmid 1976).
Family: Empididae (dance flies)	Penstemon (Schmid 1976); Frasera (Beattie et al. 1973); Antennaria (Robertson 1929).
Family: Tachinidae (tachinic flies)	Astragalus (Green and Bohart 1975); Lomatium (Schlessman 1978); Antennaria (Robertson 1929).
Family: Anthomyiidae (root maggot flies)	Penstemon (Davidse 1976); Frasera (Beattie et al. 1973).
Family: Chironomidae (midges)	Lomatium (Schlessman 1978).
Family: Sarcophagidae (flesh flies)	Antennaria (Robertson 1929); Frasera (Beattie et al. 1973).

Order: HEMIPTERA (True bugs)

Family: Berytidae	Eriogonum (Knudson 1979).
Family: Miridae	Frasera (Beattie et al. 1973).
Family: Lygaeidae	Frasera (Beattie et al. 1973).

Order: LEPIDOPTERA (Butterflies - Moths)

	Penstemon (Schmid 1976); Symphoricarpos (Robertson 1929).
Butterflies	Eriastrum (Grant and Grant 1965); Agastache, Asclepias, Cirsium, Monardella, Ranunculus (Gut et al. 1977).
Family: Danaidae (milkweed and monarchs)	Asclepias (Gut et al. 1977; Wyatt 1976).
Family: Hesperiidae (skippers)	Linanthus (Grant and Grant 1965); Lithospermum (Robertson 1929).

Family: Lycaenidae (gossamer-winged butterflies)	*Frasera* (Beattie et al. 1973); *Lithospermum* (Robertson 1929); *Asclepias* (Gut et al. 1977; Robertson 1929).
Family: Nymphalidae (brush-footed butterflies)	*Lithospermum* (Robertson 1929); *Antennaria* (Holland 1916); *Agastache*, *Asclepias*, *Cirsium*, *Monardella*, *Ranunculus* (Gut et al. 1977).
Family: Papilionidae (swallowtails)	*Asclepias* (Wyatt 1976; Gut et al. 1977); Leptodactylon (Grant and Grant 1965); *Cirsium* (Gut et al. 1977); *Lithospermum* (Robertson 1929).
Family: Pieridae (sulfur butterflies)	*Frasera* (Beattie et al. 1973); *Asclepias* (Wyatt 1976).
Moths	*Penstemon* (Schmid 1976).
Family: Geometridae	*Linanthus* (Grant and Grant 1965).
Family: Noctuidae	*Phlox* (Grant and Grant 1965); *Frasera* (Beattie et al. 1973).
Family: Pyralidae	*Camissonia* (Linsley et al. 1963); *Linanthus* (Grant and Grant 1965).
Family: Sphingidae (hawkmoths and sphinxmoths)	*Phlox*, *Leptodactylon* (Grant and Grant 1965); *Cirsium* (Gut et al. 1977); *Nicotiana* (Wells 1959); *Oenothera* (Linsley et al. 1963; Stockhouse 1975).

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APPENDIX 6

SENSITIVE AND ENDEMIC PLANTS IN THE PROJECT AREA

TABLE A6-1
SENSITIVE AND ENDEMIC PLANTS IN THE PROJECT AREA

Species	Status[1,2]	Flowering Time	Location(County)[3]
Arching antennaria Antennaria arcuata	R	July-August	Elko
Eastwood milkvetch Asclepias eastwoodiana	R	Late May-June	Lander, Nye
Alvord milkvetch Astragalus alvordensis	SC	May-July	Humboldt
Callaway milkvetch Astragalus callithrix	R	May-June	Nye
Torrey milkvetch Astragalus calycosus var. monophyllidius	SC	May-June	Eureka, Nye
Broad-pod freckled milkvetch Astragalus lentiginosus var. latus	R	May-July	Elko
Lahontan milkvetch Astragalus porrectus	T	May-June	Pershing, Churchill
Tonopah milkvetch Astragalus pseudiodanthus	T	May-June	Nye
Winged milkvetch Astragalus pterocarpus	SC	April-June	Humboldt, Lander, Pershing, Churchill
Lamoille Canyon milkvetch Astragalus robbinsii var. occidentalis	T	July-August	Elko
Squalid milkvetch Astragalus serenoi var. sordescens	T	May-June	Nye
Toquima milkvetch Astragalus toquimanus	SC	May-June	Nye
Currant milkvetch Astragalus unicialis	E[4]	May	Nye
Nevada camissonia Camissonia nevadensis	SC	May-June	Pershing

Species	Status	Flowering Time	Location (County)
Clokey pincushion cactus Coryphantha vivipara var. rosea	R	June-July	Eureka, Nye
Interrupted cryptantha Cryptantha interrupta	D	May-June	Elko, Eureka
Snowy spring parsley Cymopterus nivalis	R	July	Elko
Desert draba Draba arida	R	July	Nye, Lander
Arc Dome draba Draba crassifolia var. nevadensis	T	May-August	Nye
Inch-high fleabane Erigeron uncialis var. conjugans	E	June-July	Nye
Wind-loving buckwheat Eriogonum anemophilum	SC	June-July	Humboldt, Elko, Pershing
Undescribed buckwheat Eriogonum sp. nov.	E	June	Elko
Lemmon buckwheat Eriogonum lemmonii	SC[5]	May-June	Churchill
Pahute Green Gentian Frasera pahutensis	R	May-July	Nye
Toquima geranium Geranium toquimense	R	June-July	Nye
Watson goldenweed Haplopappus watsonii	D	June	Elko, Lander, Nye
Duran alumroot Heuchera duranii	D	May-June	Nye, Lander
Hitchcock bladderpod Lesquerella hitchcockii	R	June-August	Nye
Maguire lewisia Lewisia maguirei	E	June	Nye

Species	Status	Flowering Time	Location (County)
White-leaf machaeranthera Machaeranthera leucanthemifolia	D	May-June	Pershing, Nye
Toyiabe bluebell Mertensia toyabensis	R	July	Lander
Beautiful cholla Opuntia pulchella	SC	May-June	Nye, Humboldt, Pershing, Lander, Elko, Churchill
Nevada oryctes Oryctes nevadensis	R	April-June	Humboldt, Pershing, Churchill
Watson oxytheca Oxytheca watsonii	T	June-July	Eureka
Dune penstemon Penstemon arenarius	T	May-June	Churchill, Nye
Ruby Mountains penstemon Penstemon procerus ssp. modestus	T	July-August	Elko
Smooth phacelia Phacelia glaberrima	SC	May-June	Pershing, Lander
Inconspicuous phacelia Phacelia inconspicua	R[5]	June-July	Pershing
Ruby Mountains primrose Primula capillaris	E[5]	July-August	Elko
Nevada primrose Primula nevadensis	T	July-August	Nye
King indigo bush Psorothamnus kingii	SC	June-August	Humboldt, Churchill
Mojave fishhook cactus Sclerocactus polyancistrus	T	May	Nye
Great Basin fishhook cactus Sclerocactus pubispinus	T	May	Elko
Lobed petal silene Silene scaposa var. lobata	D	June-July	Eureka, Lander, Nye
Holmgren smelowskia Smelowskia holmgrenii	R	June-August	Nye, Lander

Species	Status	Flowering Time	Location (County)
Tufted globe-mallow *Sphaeralcea caespitosa*	T	May-June	Nye
Loose-flowered thelypody *Thelypodium laxiflorum*	D	May-June	Nye
Oval leaf thelypody *Thelypodium sagittatum* var. *ovalifolium*	R	May-July	Elko
Beatley clover *Trifolium andersonii* ssp. *beatleyae*	D	May-June	Nye
Owyhee River stickseed *Hackelia ophiobia*	E[4]	June-August	Elko, Humboldt
Fuzzy sandwort *Artemisia papposa*	SC	May-June	Elko
Solitary milkvetch *Astragalus solitarius*	R	May-June	Humboldt
Osgood Mountains milkvetch *Astragalus yoder-williamsii*	E[4,6]	June-July	Humboldt
Goodrich cymopterus *Cymopterus goodrichii*	T	July-August	Lander
Broad fleabane *Erigeron latus*	T	July	Elko
Raven biscuitroot *Lomatium ravenii*	D	May-June	Lander, Nye
Nevada phacelia *Phacelia nevadensis*	R	June	Elko
Barneby wildcabbage *Caulanthus barnebyi*	SC	May-June	Humboldt
Robust hedgehog cactus *Pediocactus simpsonii* var. *robustior*	SC	May	Humboldt

[1]E=recommended for Federal Endangered listing, T=recommended for Federal Threatened listing, R=currently undergoing review to determine appropriate status recommendation, SC=of special concern, and D=endemic to Great Basin but not currently sensitive.

[2]Status as of November 21-22, 1980, Nevada Threatened and Endangered Plant Workshop, Reno, Nevada.

[3]Locations represent only those counties in the project area, not the total range of the species.

[4]Species to be added to protected species list NRS 527.270.

[5]Species protected by NRS 527.270.

[6]Species listed as Endangered under the Endangered Species Act of 1973. FR 8/13/80.

APPENDIX 7

DATA ON PESTICIDES

TABLE A7-1

DATA ON PESTICIDES

Dollar Costs per Acre	Material Costs (Insecticide and/or Bait)	Application by Aircraft	Overhead	Total Costs per Acre	Decomposition	Grasshopper Reduction Rate	Current Viabilily
Malathion - 8 oz. per acre	$ .88	$ .38 to $1.00	$ .10	$1.36-$1.98	3 days	85%	Thoroughly Tested
Sevin 4 Oil - 20 oz. Carbaryl per acre	$1.34	$1.09 to $1.25	$ .10	$2.53-$2.69	21 days	85%	Thoroughly Tested
Sevin Carbaryl 5% Bait (for Mormon Crickets)	$7.20	$1.00	$ .10	$8.30	-----	85%	Thoroughly Tested
Nosema Locustae with bait	$1.30	$1.50	$ .10	$2.90	-----	50%	Limited Testing Approved by E.P.A.
Nosema Locustae with 2% Carbaryl bait	$2.20	$1.50	$ .10	$3.80	-----	90%	Limited Testing Not Yet Approved by E.P.A.

APPENDIX 8

NEVADA DEPARTMENT OF WILDLIFE CORRESPONDENCE

Nevada
Department
Of
Wildlife

JOSEPH C. GREENLEY
DIRECTOR

ROBERT LIST
GOVERNOR

1100 VALLEY ROAD • P.O. BOX 10678 • RENO, NEVADA 89520 • TELEPHONE (702) 784-6214

December 22, 1980

Mr. Roy Masinton
Team Leader, Grasshopper Control EA Team
Bureau of Land Management
Elko District Office
P.O. Box 831
Elko, NV 89801

Dear Roy:

Enclosed please find various AMS maps which depict grasshopper infestation areas and the various fish and wildlife resource values which we evaluated relative to the potential impacts of the proposed grasshopper control project.

As we discussed with you in Elko on December 15, this information was presented to the State Board of Wildlife Commissioners at their regular meeting on December 19, 1980. That Board passed a motion supporting a grasshopper control project with the following stipulations or environmental safeguards:

1. Highest value fishery streams, as delineated in blue on the enclosed maps, to be avoided from pesticide application. No pesticide should be applied within 50 yards of either side of these streams, thereby creating a 100 yard non-application swath along the drainage course.

2. Known Swainson's hawk use areas (potential nest sites) and known nest sites - no pesticide application to occur within a ¼-mile buffer zone of these areas as shown on the maps (brown areas with cross hatching).

The above recommendations represent the official position of the Nevada Department of Wildlife and the State Board of Wildlife Commissioners.

We have already provided you with a copy of the class definitions for the fishery resources. The Swainson's hawk is a species which has been declining in distribution and numbers in Nevada during the past 50 or more

years. The long term population trend is down for this species. The proposed grasshopper control areas do encompass some important Swainson's hawk use and nesting areas, although most are on private land. This bird is a primary grasshopper consumer and can be expected to have young in the nest anytime between the first of June and mid-August. Hence, our concern for the welfare of this species. If the recommendation to protect Swainson's hawk is included in the final decisions, we will make every effort to have one of our nongame biologists locate and flag these sites so that they can be readily identified and avoided during the pesticide application process.

We plan to work with the BLM, U.S. Forest Service and U.S. Fish and Wildlife Service to monitor the impacts of this spray program on fish and wildlife resources. Our major efforts will be directed at monitoring impacts to aquatic ecosystems and fish populations. We also hope to monitor impacts to some raptors and sage grouse.

We will notify the primary decision makers (State Director - BLM, Regional Forester - Forest Service, and APHIS) of our recommendations and the position of the Wildlife Commission on this issue. If you have any further questions on our input or recommendations, please contact Willie Molini of my staff.

Sincerely,

William D. Parsons

William Parsons
Acting Director

WM:pw

Enclosures

MAPS

APPENDIX 9

U.S. ENVIRONMENTAL PROTECTION

AGENCY CORRESPONDENCE

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

JAN 06 1981

OFFICE OF
PESTICIDES AND TOXIC SUBSTANCES

Mr. Delmar Vail
Director
U.S. Department of Interior
Bureau of Land Management
Washington, D.C. 20240

Dear Mr. Vail:

Thank you for your letter of December 1, 1980 concerning the APHIS grasshopper control program.

I regret that, due to travel budget constraints, I was unable to send a representative to the meeting in Reno on this matter. However, I will take this opportunity to clarify EPA's position on direct application of pesticides to sensitive areas including aquatic sites. This position was formally communicated to APHIS last spring in our comments on the Rangeland Grasshopper Cooperative Management Program EIS. I am concerned that APHIS apparently did not bring this to your attention.

In the letter to APHIS, we noted that a prohibition against direct application to aquatic sites is more appropriate than an admonition to avoid direct application to such sites. In fact, it is only logical that no direct application to a sensitive area is the first step one would take to minimize contamination of that area. We further recommended that applicators observe specific buffer zones when spraying near critical fisheries and municipal water supplies; the recommended buffer zones ranged from 300 feet to 1/2 mile. With respect to lakes, streams, and ponds, which I understand is your primary concern, we accepted USDA's assurances that by following the guidance and procedures for mitigating drift contained in the APHIS Grasshopper Program Manual, these areas would be adequately protected.

Several weeks after we sent our comments on the EIS to APHIS, we received the manual. After reviewing it, we concluded that it did not contain sufficient guidance on how pesticide spray drift into sensitive areas could be minimized. We thus urged APHIS to revise the manual and offered specific comments to assist them in their revisions. In these comments we reiterated our position that direct application to aquatic sites should be prohibited and underscored our concern that definitive operational guidelines be developed to ensure adequate protection of lakes, streams, and ponds.

It is important to note that the recommendations we made to APHIS were merely that -- recommendations, not a formal enforcement position. Whether or not they were to be adopted was a decision left to APHIS and the cooperating parties. It is apparent that APHIS chose not to adopt them, but rather to try to comply with the label precaution. However, all parties must understand that EPA's recognition, as stated in John Ritch's May 19, 1975 letter, that drift is inevitable when pesticides are applied aerially, does not absolve the user of liability should contamination of lakes, streams and ponds, or any other sensitive areas, occur. Nor does it imply that the applicator has no responsibility to try to minimize drift into sensitive areas.

In closing, I urge you to work with APHIS to develop application practices which will minimize contamination of sensitive areas and at the same time provide an adequate level of control. Although it would be entirely proper to adopt the specific recommendations we have already offered APHIS, we recognize that special local conditions may warrant modification of the standards. We would be happy to work with you should you wish to explore this option further. Please let me know if you think a meeting would be helpful.

Sincerely,

Douglas D. Campt
Director
Registration Division (TS-767)

APPENDIX 10

U.S. FISH AND WILDLIFE SERVICE

THREATENED AND ENDANGERED SPECIES CONSULTATION

UNITED STATES GOVERNMENT

memorandum

DATE: JAN 8 1981

REPLY TO ATTN OF: Area Manager, Boise, ID

SUBJECT: ESA Formal Section 7 Consultation Number 1-1-80-F-41, Subject: Malathion Use for Grasshopper Control in Five Northern Nevada Counties

TO: State Director, BLM, Reno, Nevada

This is in response to your March 14, 1980 request for formal Section 7 consultation persuant to the 1973 Endangered Species Act, as amended, for the use of malathion during the grasshopper control program proposed for five counties in northern Nevada. Your request states that this program may affect the listed endangered bald eagle (Haliaeetus leucocephalus) and threatened Lahontan cutthroat trout (Salmo clarki henshawi). We do not concur with your determination of the effect to the bald eagle. We have determined there will be no effect to this species as it is only an autumn and early winter occupant of the program area. With the program scheduled for spring and early summer, there will be no conflict between the program and bald eagle, and therefore no effect.

We have concluded, however, that the program may affect other listed species and species that are candidates for future listing. A review of the impact areas indicates the program may affect a listed endangered plant, Astragalus yoder-williamsii, the candidate plant Eriogonum argophyllum, the candidate Clover Valley speckled dace (Rhinichthys osculus oligoporus) and Andrena thorpi, a bee found at the Paradise Valley sand dunes, Humbolt County. These species, and the influence the proposed program may have on them, will be discussed in this biological opinion.

Candidate species are afforded no legal status under the 1973 Endangered Species Act, as amended. They are included herein to request federal agencies to undertake the spirit of the Endangered Species Act by initiating programs to conserve species whose distribution is limited and/or biological status is declining. By conducting these types of programs, legal protection under the Endangered Species Act may be avoided.

This biological opinion is issued in accordance with your May 20, 1980 request for extension of consultation to January 1981. Rather than being a programmatic biological opinion (addressing the impacts over all of northern Nevada), it will be concerned only with the 1981 program.

The Bureau of Land Management (BLM) has taken the lead in this matter for the land management agencies involved in this program. Three agencies are involved: BLM, the U.S. Forest Service (USFS), and the Bureau of Indian Affairs (BIA). At the issuance of this biological opinion, the Animal and Plant Health Inspection Service (APHIS) has yet to be enjoined in formal Section 7 consultation on this program.

BIOLOGICAL OPINION

It is the biological opinion of the Fish and Wildlife Service that the 1981 grasshopper control program is likely to jeopardize the continued existence of *Astragalus yoder-williamsii*, but that it is not likely to jeopardize the continued existence of the Lahontan cutthroat trout.

PROJECT DESCRIPTION

From data collected during their autumn 1980 field surveys, APHIS notified concerned federal agencies that lands under their administration may be economically and sub-economically infested with grasshoppers (*Melanoplus sanguinipes*) during the 1981 growing season. With this notification, APHIS included maps showing the approximate infestation boundaries and a recommendation that these agencies and citizens request APHIS to treat these areas to minimize range and crop damage.

With few exceptions, the September 1980 APHIS notification is similar to that issued late in 1979. It did, however, report that economic infestations of the mormon cricket (*Arabrus simplex*) are likely to exhibit themselves during the 1981 growing season. In anticipation of this infestation, APHIS likewise recommended a control program for this species. Mention of treatment was not made in the BLM request for consultation. However, it will be discussed in this biological opinion because of its probable effect to the respective listed species.

The APHIS September 1980 notice of anticipated infestation sent to concerned federal agencies and private citizens states that the anticipated 1981 economic infestation of grasshoppers and mormon crickets will include approximately 37,000 acres of BIA land, 232,552 acres of BLM land, 92,000 acres of USFS land, and 224,046 acres of private land. The total grasshopper infestation is thereby estimated to include a total of 585,598 acres in northern Nevada. The notice also predicted that mormon cricket infestation will inlcude 4,860 acres of BLM land, 6,480 acres of USFS land, and 4,580 acres of private land. This infestation is thereby estimated to include a total of 15,920 acres. The total infested acreage of each insect is difficult to estimate from maps prepared by APHIS. Using these maps, BLM estimates more than one million acres are proposed for treatment.

The boundaries of infestation, and the density of pests, are approximate and liable to change as spring approaches and insect hatching begins. Less acreage may be economically or sub-economically infested should adverse weather elevate juvenile mortality rates, and conversely, the area infested may be greater if hatching and growing conditions are optimal. Spring 1981 field surveys will provide data to specifically delineate the treatment areas and schedule treatment.

The control program recommended by APHIS will utilize either, or both, malathion and carbaryl. Malathion will be primarily used to control grasshoppers, and carbaryl to control mormon crickets. Ninety-one

percent technical grade malathion will be applied aerially or by ground rig in a single application at the ultra low volume rate of eight ounces actual per acre. When applied to control grasshoppers, carbaryl Sevin 4 oil, 49 percent A.I., will be spread aerially, or by ground rig, during a single application at the rate of 20 ounces per acre (16 fluid ounces Sevin 4 oil plus four ounces diesel). To control mormon crickets, carbaryl bait consisting of five percent A.I, and 95 percent steamrolled wheat or wheat bran will be applied by either ground rig or air at a rate between 5 and 40 pounds per acre. There is no mention made of how many times carbaryl will be applied to infested areas.

This biological opinion is prepared from information included in your request for consultation, the "Environmental Assessment, Grasshopper Control Program" for the proposed 1980 treatment, conversations with numerous authorities knowledgeable of the effects insecticides have on biota, and a review of pertinent literature.

SPECIES ACCOUNTS

The Lahontan cutthroat trout is native to the Lahontan drainage basin of the Pleistocene epoch (La Rivers 1962), where it and the Paiute cutthroat trout (*Salmo clarki seleniris*) represent the only historic occupants of the family *Salmonidae*. Historically, the Lahontan cutthroat trout was widely distributed throughout varied habitats ranging from highly alkaline lakes to small headwater streams (Moyle 1976). The species status began declining as aquatic habitats in the Lahontan basin were degraded by severe overgrazing and stream diversions (Behnke and Zarn 1976; La Rivers 1962). The species was additionally extirpated by competition and hybridization resulting from the introduction of game fishes (Behnke 1979).

The Nevada Department of Wildlife (NDOW), USFS and BLM, are cooperating in a continuing program to survey all Lahontan basin streams in Nevada for their habitat quality and fish population. Encouragingly, these surveys have identified additional, heretofore unknown, populations of Lahontan cutthroat trout; however, they have also found that stream habitats are frequently in poor conditions and, where found, the Lahontan cutthroat trout is commonly cohabitating with introduced, competing fishes. That poor habitats and competition from introduced fishes have extirpated this species from other locations is enough to warrant concern for the livelihood of this cutthroat trout in its remaining habitats. NDOW currently estimates that Lahontan cutthroat trout occupy 67 different habitats within the state (Coffin pers. comm. November 1980).

The Lahontan cutthroat trout is an obligatory stream spawning fish and reproduces in mid to late spring over rock and/or cobble substrates located in swiftly flowing water. The spawning female digs nests in the substrate into which she deposits her eggs. Fertilization is external and occurs as the female extrudes her eggs into the nest. The embryos incubate in the substrate and hatch to swim from the nest into slow

moving, protected stream margins. The incubation period varies in length in accordance with environmental factors such as dissolved oxygen concentrations and water temperature. The incubation and early emergent phases of life history are periods when these fish are most vulnerable to mortality.

The Lahontan cutthroat trout feeds primarily on drifting invertebrates throughout its juvenile and young adult growth stages. As aging continues, the diet changes to include fish and larger invertebrates. In stream environments where the species is found today, this cutthroat trout does not get much larger than "pan size". In lakes, however, it becomes much larger. Before this cutthroat trout was extirpated from Pyramid Lake, Washoe County, Nevada, it was recorded as weighing 30 pounds more then, and regarded as the largest trout in western North America (La Rivers 1962).

Astragalus yoder-williamsii and its critical habitat was listed as endangered under an emergency rulemaking on August 13, 1980 (45 *FR* 53968), because of severe threats posed to its livelihood by mining operations. The species is known from two collections, one at its designated critical habitat in Humboldt County, Nevada, and at an area in southern Idaho where it has been unsuccessfully relocated since its first collection. The population in the Osgood Mountains, Humboldt County, Nevada, was estimated at 500 individuals in 1979.

There is little known about the ecology of this species. It is found on xerent soils composed of gravel derived from granodiorite parent material. It is on hilltops where vegetation is low and dominated by *Artemesia arbuscula* and *Poa sandbergii*. Also in association are *Penstemon humilis*, *Happlopappus acaulis*, *Lygodesmia spinosa*, *Pyeryxia terebintha*, and *Stanleya viridiflora*. Recent investigations have shown that this *Astragalus* is specifically pollinated by a bee of the genus *Osmia*. The intimate relationship between these organisms indicates that detrimental influences to either would concommitantly affect the other.

The two candidate species, *Eriogonum argophyllum* and the Clover Valley speckled dace are located solely on private land and will therefore not be affected by the 1981 spray program proposed for federally administered lands. They are being discussed in the context of this biological opinion because the program, as proposed by APHIS, may affect them, and with no formal means to express concerns to APHIS, there is seemingly no better mechanism to air suggestions for their conservation than in this discussion.

Eriogonum argophyllum is a member of the buckwheat family of plants (Polygonaceae). It is included on Nevada's Critically Endangered Species List (NRS 527.270) and recognized as endangered by the Northern Nevada Native Plant Society. The species is known only from a single population at its type locality in Ruby Valley, Elko County (T. 31N, R. 59E, Sec. 11). The entire distribution lies within an anticipated sub-economic grasshopper infestation zone.

There is little known of the species biology. The pollinators of

Eriogonum argophyllum are unknown; however, there is a good likelihood of a specific pollinator (Stephen et. al. 1969).

The Clover Valley speckled dace is recognized as one of two speckled dace within the pluvial Lake Clover drainage (Hubbs, Miller, and Hubbs 1974). Hydrographic and taxonomic evidence indicate that both of these forms are derived from the Lahontan speckled dace (Rhinichthys osculus robustus) (Hubbs, Miller, and Hubbs 1974), currently found throughout the Humboldt, Reese, Susan, Quinn, Walker, Carson, and Truckee River basins of the pluvial Lahontan drainage system (La Rivers 1962).

Two small springs situated along the western shoreline of Pluvial Lake Clover (Clover Valley, Elko County, Nevada) are the sole Clover Valley speckled dace habitats. These springs are located on the Warm Springs Ranch (T. 33N, R 61E, Sec. 7) and Wright Ranch (T. 33N, R 61E, Sec. 12 (Hubbs, Miller, and Hubbs 1974)).

Little is known of the species current status, as the springs have not been recently surveyed. The species is undoubtedly in much worse condition than historically because its habitats have been dramatically altered for irrigation, and game fishes introduced.

The speckled dace is a small, non-schooling fish occupying streams and lakes. It prefers riffle areas in streams and the shallow portions of lakes. It is an omniverous feeder, foraging through the substrate to consume small insects, microcrustuceans, and plants (Moyle 1976). Spawning occurs in late spring and early summer.

ANALYSIS OF IMPACTS

The deleterious effect of malathion on aquatic ecosystems is of such magnitude that it has been subject of numerous laboratory and field investigations. There has been no analysis of how sensitive the Lahontan cutthroat trout and Clover Valley speckled dace are to malathion; however, numerous studies have dealt with the effect of malathion on closely related fishes and organisms typically inhabiting ecosystems occupied by these fish.

Malathion affects animals by depleting acetylcholinesterase reserves in the nervous system, which in turn reduces the ability of body musculature to perform properly (Post and Leasure 1974). If the dose is adequate, mortality will occur. Sublethal concentrations of malathion may indirectly cause mortality by reducing an organism's ability to move and thereby influence its ability to avoid predation and adequately feed. These sublethal effects may be rather long-lived as depleted acetylcholinesterase resynthesizes slowly (Koelle and Gilman 1949; Post and Leasure 1974).

Animal components of aquatic ecosystems are variously sensitive to malathion. Laboratory (Brown 1978; Gaufin 1961; Naqui and Ferguson 1968; Pimentel 1971; Post and Schroeder 1971; Saunders and Cope 1966, 1968)

and field investigations (Giles 1970; Hendersen, 1967; USDI 1965-1966) indicate that invertebrates are more sensitive than fish. High mortality to invertebrates, including the virtual elimination of some types, are well documented for spray programs using malathion applied at the rate proposed for the 1981 program in northern Nevada (Giles 1970; Hendersen 1967).

Aquatic invertebrates are generally more sensitive to malathion than fish. However, laboratory analyses of the salmonid sensitivity to malathion (Macek and McAllister 1970; Sonders and Cope 1968) indicates that these fishes have a sensitivity very near that determined in similar laboratory studies concerning aquatic invertebrates (Brown 1978; Gaufin 1961; Naqui and Ferguson 1968).

Sensitivity data collected in the laboratory is rarely shown in the field (Giles 1970), as the toxicity of malathion varies from one water to another with differences in water chemistry and water temperature. Macek, Hutchinson, and Cope (1969) and Cope (1965) note, respectively, the bluegill (*Lepomis macrochirus*) and rainbow trout fingerling (*Salmo gairdneri*) sensitivity to malathion increases with increasing temperatures. Spiller (1961) notes that malathion toxicity in aquatic systems increases with acidity (EPA 1975) as well as the relationship between mortality and alkalinity.

Streams influenced by past insect spray programs have been monitored for the effect of malathion. As might be expected, these programs variously affected fish populations. Hendersen (1967b) and Kerswill and Edwards (1967) noted salmonid mortalities in streams aerially sprayed at an eight ounces per acre rate. Mortalities were often encountered where spray swaths overlapped. Oakley (September 10, 1980 letter) also noted extensive fish kills during a malathion spray program. USDI (1965-1966; 1966) saw no fish mortality during spray programs where malathion was applied at eight ounces per acre. USDI (1966), however, noted that fish taken from a sprayed stream showed a 40 percent reduction in brain cholinesterase activity from that seen in pre-spray fish. While monitoring streams during spray programs similar to that proposed for 1981, Hendersen (1967b) noted that malathion concentrations too low to noticeably effect fish in live cages, caused mortality to free-swimming fish able to feed on the increased insect drift.

Of the insecticides currently available for widespread use, malathion is one of the least persistent (EPA 1975). Its decomposition rate in aquatic environments depends on environmental factors, such as water chemistry and water temperature. Under respective conditions it may linger up to ten days, or decompose almost immediately. Decomposition consists of hydrolysis to compounds that are often equally and more toxic to aquatic life than malathion (EPA 1975; McKee and Wolfe 1963; Wilson 1966).

The above information shows how a malathion spray program will detrimentally influence Lahontan cutthroat trout and Clover Valley speckled

dace populations. Maps of the economic and sub-economic infested areas, prepared by APHIS, show that approximately fourteen Lahontan cutthroat populations may be sprayed during 1981. Nine of these populations lie within anticipated economically infested areas. Considering the available information, it is highly likely that Lahontan cutthroat trout mortalities will occur in those populations sprayed. However, the mortality noted in similar spray programs (Giles 1970; Hendersen 1967; Oakley, 1980 letter), and the total number of Lahontan cutthroat trout populations currently found throughout its range that anticipated mortalities will minimally affect the status of the species. The mortality that will occur is not anticipated to markedly deplete a population. Likewise, there should be no long-termed effect to these populations. The treatment may depress food availability; however, this should be a temporary condition. Insect numbers are known to re-establish quickly following treatment. Giles (1970) noted that treatment caused a shift in insect diversity; however, this should have no significant influence on trout feeding, and hence livelihood.

The insecticide Carbaryl Sevin 4 oil is a acetylcholinerase inhibitor whose physiological effect to animals is similar to that of malathion. Differing from malathion, however, it is far more persistent in the environment. Burdick et al. (1960) observed that it depressed the insect populations in an eastern U.S. stream for approximately one month. It is noteably toxic to bees (O. Hymenoptera).

The persistence of carbaryl Sevin 4 oil suggests that it will have a more deleterious effect to Lahontan cutthroat trout populations than malathion. That application of this insecticide to control mormon crickets is anticipated to influence less than five Lahontan cutthroat trout populations suggests that anticipated mortalities will not dramatically influence the species' status. This is likewise true if carbaryl is used over a wide area to control grasshoppers. That 14 of the known 67 populations may be sprayed suggests that mortality will not be of a degree that it will markedly influence the species' livelihood.

The application of carbaryl Sevin 4 oil may dramatically affect the Clover Valley speckled dace. The cited effect of this pesticide to aquatic ecosystems, compounded by the location of all Clover Valley speckled dace populations within anticipated subeconomic grasshopper infested areas, conjunctively indicate that the grasshopper control program will deleteriously affect the status of this fish.

Located in the north-central portion of the Osgood Mountains, (Astragalus yoder-williamsii may be affected during the treatment of two anticipated economic grasshopper infestations situated two to three miles to the west, along the base of the mountain range. Direct contact by either insecticide should have no effect on the plant; however, direct and incidental exposure is likely to severely impact the pollinating bee (Johansen et al. 1965, Johansen 1977; Tepedino 1979). Pollinator depletion by malathion and carbaryl has been little studied. However, the depletions noted in spray programs involving other insecticides (Kevan

1975; Plowright et al. 1978; Robinson and Johansen 1978) and the sensitivity of bees to each compound (Andersen and Atkins 1958; Levin et al. 1968) strongly suggest the influence may be dramatic.

The pollinating bee is locally distributed and apparently dependent on Astragalus yoder-williamsii for at least a portion if its life history. Likewise, this Astragalus is intimately dependent on the bee for pollination (Parker, pers. comm. 1980). In ecological arrangements similar to this, it is common to find the flight period of a pollinator occurring coincidentally with the flowering period of the associated plant. (Stephen et al. 1969). This intimacy suggests that the livelihood of each species is closely dependent on that of the other (Tependino 1979).

Mortality to this bee may have a rather long-termed influence on Astragalus yoder-williamsii. Bees have a typically low fecundity (Stephan et al. 1969; Tepedino 1979), indicating that population recovery from sizeable mortality is slow. Plowright et al. (1978) estimated that three to four years were required for a bumble bee population to retain its pre-spray level. By reducing pollinators for an extended period, Astragalus yoder-williamsii will be influenced by concommitantly low pollination and, hence, reduced reproductive success. Depletion of a pollinator for this length of time further increases the risk that other environmental and man-made factors may severely impact the species (Tependino 1979).

Although Astragalus yoder-williamsii is not located within an anticipated spray zone, its pollinator may be severely affected by drift insecticide (Shay pers. comm. December 1980) and/or by the pollinator foraging in areas where the insecticide is applied (Parker pers. comm. December 1980). Parker (pers. comm. December 1980) relates that malathion spray programs have killed honey bees (Apis mellifera) at a distance of five miles from target spray zones. The bee is most vulnerable to insecticide mortality during the weeks of its flight period (Stephen et al. 1969). The period for this occurs with the flowering of Astragalus yoder-williamsii; during late spring and early summer. The flight period will probably occur during the time anticipated for the 1981 spray program.

The grasshopper control program is likely to similarily effect Eriogonum argophyllum located totally within the bounds of an anticipated sub-economically infested area in Ruby Valley. There are no know pollinators specifically associated with this plant; however, this may be a function of our extremely limited knowledge of the plant's ecology.

Andrena thorpi is a ground nesting bee known from only the Paradise Valley sand dunes north of Winnemucca (Linsley and MacSwain 1962). Its flight period occurs in early June. This species is not immediately threatened by the 1981 spray program; it is mentioned here in the event that economic or subeconomic infestations are identified in its vicinity during the spring, and control measures undertaken. Andrena thorpi will be affected in a manner similar to that discussed above for the undescribed species of Osmia.

Cumulative Effects

The 1981 grasshopper control program will have no cumulative effect on the Lahontan cutthroat trout. This program may have a cumulative effect on Astragalus yoder-williamsii by depleting its pollinator to such a degree that other man-made factors, such as mining may seriously degrade its current status.

Biological Opinion

It is the Biological Opinion of the FWS that the 1981 grasshopper control program is not likely to jeopardize the continued existence of the Lahontan cutthroat trout, but that it is likely to jeopardize the continued existence of Astragalus yoder-williamsii.

The 1978 amendments to the Endangered Species Act include a mandate that "reasonable and prudent alternatives" be provided when a Biological Opinion indicates jeopardy to a listed species. "Reasonable and prudent alternatives" refer to alternate courses of action open to the federal agency with respect to an activity or program that are technically capable of being implemented and consistent with the intended primary purpose of the activity or program. To preclude jeopardy and provide for the conservation of Astragalus yoder-williamsii we offer the following alternative to the proposed action.

I. Do not apply insecticides to any economic and sub-economic pest infestations within a distance of five miles from the outermost periphery of the Astragalus yoder-williamsii population. This buffer area will prevent spray drift from reaching the plant and provide the bee with a sufficient, insecticide-free foraging area.

   In accordance with the spirit and intent of the 1973 Endangered Species Act, as amended, and to further promote the conservation of species, we recommend the following considerations for the 1981 grasshopper control program.

   1. Spray Lahontan cutthroat trout habitats in a manner so as to truely minimize the effect of insecticides to the aquatic and riparian environment. This may well be accomplished by incorporating the guidelines recommended for riparian protection by the NDOW Commission during their December 19, 1980 meeting.

   2. Cooperate with FWS and NDOW to monitor the effects of this program on Lahontan cutthroat trout and its habitats.

   3. Do not permit insecticides to deleteriously affect the Clover Valley speckled dace, or its supporting aquatic ecosystem. Protection to these habitats may be afforded by maintaining a 100 yard boundary around them and by limiting spraying only to windless days.

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cc: Congressr
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4. Implement measures to protect <u>Eriogon</u>
<u>Andrena</u> <u>thoroi</u> from the detrimental i
pesticides. These species may be pro
boundary zones similar to that recomm
<u>yoder-williamsii</u>.

We request that consultation for this project r
communication during implementation. Should th
contact Mr. Don Sada at FTS: 470-5227 or comm.

L. A. Mehrho

cc: Congressman Santini
FAO Reno, Reno, NV
SE, Sacramento, CA

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